This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

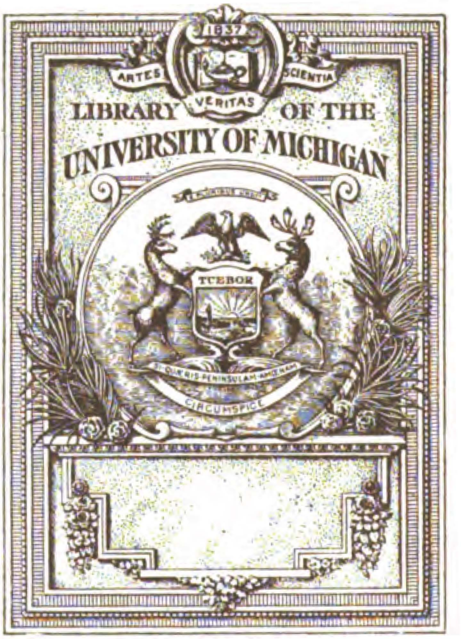
About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

B 479224

WEST VIRGINIA GEOLOGICAL SURVEY

Google



1837
ARTES VERITAS SCIENTIA
LIBRARY OF THE
UNIVERSITY OF MICHIGAN
E PLURIBUS UNUM
TUEBOR
SI QUAERIS PENINSULAM AMOENAM
CIRCUMSPICE

SCIENCE Library
QE
178
.D6
A3
1912

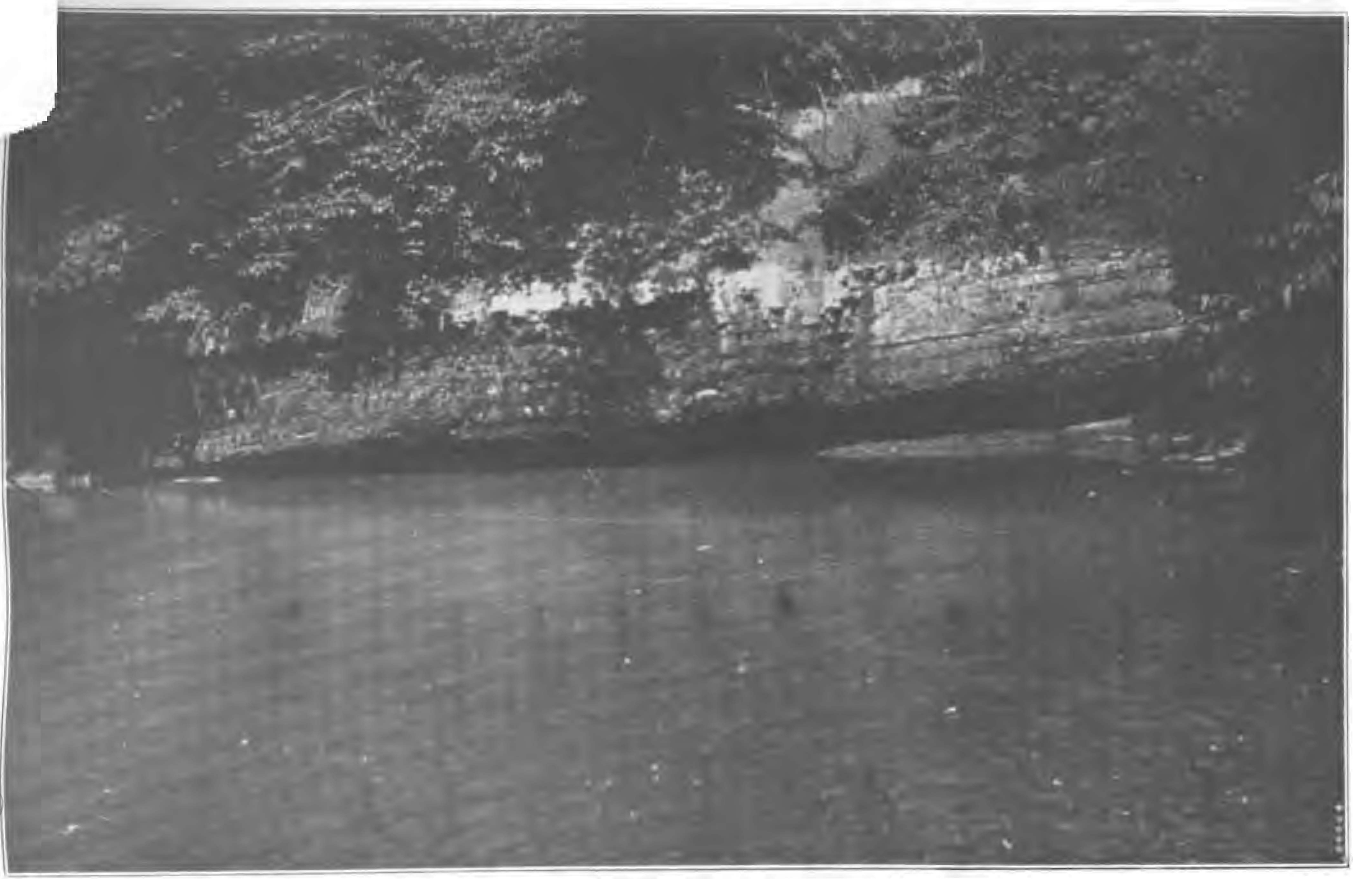


PLATE I.—Pittsburgh Coal Bed passing below Bingamon creek on the eastern slope of the Wolf Summit anticline, ¼ mile S. W. of Pine Bluff.

WEST VIRGINIA
GEOLOGICAL SURVEY

JUNE 20 1863

Doddridge and Harrison Counties.

BY

RAY V. HENNEN, Assistant Geologist.

I. C. WHITE, State Geologist.

Wheeling News Litho. Co.
WHEELING, W. VA.
1912

GEOLOGICAL SURVEY COMMISSION.

WILLIAM E. GLASSCOCK.... ....*President*
GOVERNOR OF WEST VIRGINIA.

E. L. LONG................................*Vice President*
TREASURER OF WEST VIRGINIA.

ARCHIBALD MOORE..........................*Secretary*
PRESIDENT, STATE BOARD OF AGRICULTURE.

THOMAS E. HODGES........................*Treasurer*
PRESIDENT, WEST VIRGINIA UNIVERSITY.

E. DWIGHT SANDERSON...............*Executive Officer*
DIRECTOR, STATE AGRICULTURAL EXPERIMENT STATION.

STATE BOARD OF CONTROL.

JAMES S. LAKIN..............................*President*
E. B. STEPHENSON.........................*Treasurer*
JOHN A. SHEPPARD.

388289

STATE OF WEST VIRGINIA
JUNE 20 1863
MONTANI SEMPER LIBERI

SCIENTIFIC STAFF.

I. C. WHITE SUPERINTENDENT OF THE SURVEY.	*State Geologist*
RAY V. HENNEN	*Assistant Geologist*
CHARLES E. KREBS	*Assistant Geologist*
DAVID B. REGER	*Field Assistant*
D. D. TEFTS, JR.	*Field Assistant*
BERT H. HITE	*Chief Chemist*
JAN B. KRAK	*Assistant Chemist*
EARL M. HENNEN	*Chief Clerk*
JENKIN L. WILLIAMS	*Stenographer*

LETTER OF TRANSMITTAL.

To His Excellency, Hon. William E. Glasscock, Governor of West Virginia, and President of the West Virginia Geological Survey Commission:

Sir: I have the honor to transmit herewith the Detailed Report on Doddridge and Harrison counties, prepared by Assistant Ray V. Hennen and his Aid, D. B. Reger. The Report and accompanying Geologic map, like all of Mr. Hennen's and Mr. Reger's work, speak for themselves in revealing careful, accurate and painstaking labor with the data collected, so set forth and presented as to be eminently practical and generally useful to all classes of the citizens of these two counties. The structural map showing by contours on the Pittsburgh coal the several arches and troughs, or wrinkles in the earth's crust which traverse the area in question, will prove of great value not only to those interested in coal mining operations, but also to any who are interested in oil and gas.

Based upon these structural maps, Mr. Hennen's "suggestions" in his Wirt, Calhoun and Roane County Report, have already led directly to the discovery of a large, new oil pool, and his "suggestions" of possible new oil and gas pools made in this Report will doubtless lead to like results. The western limit of the famous Pittsburgh coal when it fades away underground below minable thickness is continued across Doddridge county from where Mr. Hennen had previously brought it through Wetzel and Tyler counties, as indicated on the geologic map, and should be carefully studied by those interested in coal along this critical limit. The accuracy of this line is much greater on this larger scale map than it was possible to have it on the general State map, but, of course, there may be small areas of Pittsburgh coal even westward of this line on the Doddridge-

Harrison map where the coal in question may have commercial thickness, but these areas will prove extremely limited in extent.

The excellent soil map and soil studies made in cooperation with the Bureau of Soils by the experts of the U. S. Department of Agriculture, published as a portion of this Report, will prove of especial value to the agricultural interests.

Very respectfully,

I. C. WHITE, State Geologist.

Morgantown, W. Va., September 1st, 1912.

CONTENTS.

Page.

Members of Geological Survey Commission and State Board of Control.. III
Members of Scientific Staff.................................. V
Letter of Transmittal.................................. VI
Table of Contents.................................. VIII-XII
Author's Preface.................................. XIII-XVI
Errata.................................. XVI

PART I. HISTORY AND PHYSIOGRAPHY.

Chapter I.—Historical and Industrial Development............ 1-32
  Location.................................. 1
  History of Transportation.................................. 1-5
    Water-ways.................................. 1-2
      West Fork River.................................. 1-2
    Steam Railroads.................................. 2-3
      Baltimore and Ohio Railroad.................................. 2-3
    Electric Railroads.................................. 3-4
      Fairmont and Clarksburg Traction Company........... 3-4
    Highways.................................. 4-5
      Northwestern Turnpike.................................. 4
      Clarksburg and Philippi Turnpike.................................. 5
      Shinnston and Middlebourne Turnpike.................................. 5
  General Description.................................. 6-32
    Doddridge County.................................. 6-10
      Miscellaneous Items.................................. 6-8
      Towns and Industries.................................. 8-10
    Harrison County.................................. 10-32
      Miscellaneous Items.................................. 10-13
      Towns and Industries.................................. 13-32
Chapter II.—Physiography.................................. 33-47
  Physiographic Changes.................................. 33-37
  Description of Drainage Basins.................................. 37-46
  Topography of the Land Area.................................. 46-47

PART II. GEOLOGY.

Chapter III.—Structure.................................. 48-66
  Introduction.................................. 48
  Method of Representing Structure.................................. 49-50
    Table of Washington Coal—Pittsburgh Coal Intervals..... 51
  Detailed Geologic Structure.................................. 53-66
    Anticlines.................................. 53-60
    Synclines.................................. 60-66
Chapter IV.—Stratigraphy—General Sections................. 67-131

Page
Introduction 67-69
Doddridge County Sections 69-89
Harrison County Sections 89-129
Thickness of Stratified Rocks 130-131
Chapter V.—Stratigraphy—The Dunkard Series 132-177
General Account and Section 132-136
Doddridge County Sections 136-140
Harrison County Sections 140-143
Description of Formations 143-176
Age of Series 177
Chapter VI.—Stratigraphy—The Monongahela Series 178-219
General Account and Section 178-179
Sections 180-183
Description of Formations 184-219
Chapter VII.—Stratigraphy—The Conemaugh Series 220-269
General Account and Section 220-221
Sections 221-224
Description of Formations 224-269

PART III. MINERAL RESOURCES.

Chapter VIII.—Petroleum and Natural Gas 270-559
Oil and Gas Horizons 270-272
Description of Sands 273-285
Oil and Gas Development, Historical 285-287
Doddridge County Well Records 287-405
  Summarized Records 287-303
  McClellan District 304-326
  Grant District 327-350
  West Union District 350-362
  Central District 363-369
  Southwest District 370-380
  Cove District 381-386
  New Milton District 386-396
  Greenbrier District 396-405
Harrison County Well Records 406-559
  Summarized Records 406-426
  Sardis District 426-451
  Ten Mile District 451-473
  Union District 474-483
  Eagle District 484-505
  Clay District 505-522
  Coal District 522-528
  Clark District 528-530
  Simpson District 531-538
  Grant District 538-553
  Elk District 554-559
Chapter IX.—Coal 560-640
Statistics of Coal Production 560-565
Coals of the Dunkard Series 565-568
  Washington Coal 565-568
Coals of the Monongahela Series 568-617
  Uniontown Coal 568-569
  Redstone Coal 569-573
  Pittsburgh Coal 573-617

Page
Country Banks.................................... 573-577
Commercial Mines.................................. 577-617
Coals of the Conemaugh Series............................ 617-618
Harlem Coal.. 617-618
Coals of the Allegheny Series............................ 618-620
Summary of Available Coal................................ 620-621
Minable Coals by Magisterial Districts.................... 621-632
Doddridge County..................................... 621-624
Harrison County...................................... 625-632
Table of Coal Analyses................................... 632-640
Page Reference of Mines.................................. 641-642
Chapter X.—Clays, Road Materials, Building Stones, Forests and Carbon Black.................................. 643-660
Clays and Clay Industry.................................. 643-646
Potteries 643-644
Transported Clays.................................... 644-646
Brick Plants... 646-650
Road Material.. 650-651
Limestones 650
River and Creek Gravels.............................. 651
Building Stone... 651-653
Forests 653-655
Carbon Black Industry.................................... 656-660
Account of Factories................................. 656-657
Manufacture of Carbon Black.......................... 657-660
Chapter XI.—Soil Survey.................................. 661-695
Climate 661-666
Agriculture 666-671
Soils 671-692
Summary 692-695
Appendix.—Levels Above Mean Tide......................... 696-697
Grafton and Parkersburg Branch of B. & O. R. R........... 696
Monongahela River Branch of B. & O. R. R................. 696
W. Va. and Pittsburgh Branch of B. & O. R. R............. 697
W. Va. Shortline Branch of B. & O. R. R.................. 697
Index 698

ILLUSTRATIONS.

Maps in Atlas (under separate cover).

Topographical Map of the Doddridge-Harrison Area.

Map Showing Economic Geology and Structure Contours of Pittsburgh Coal.

Soil Map of the Doddridge-Harrison Area.

Plates.

No. Facing Page
I.—Pittsburgh Coal Bed Passing Below Bingamon Creek on the Eastern Slope of the Wolf Summit Anticline, ¼ mile Southwest of Pine Bluff.................................Frontispiece
II(a).—Handling Pipe at Tollgate for a Large Natural Gas Line for this Region.. 8
II(b).—Same. Also Topography of the Dunkard Series......... 8
III(a).—Topography of the Monongahela Series at Reynoldsville, Harrison County.. 36
III(b).—Same Slightly Farther East.......................... 36
IV.—Wide Valley Eroded by Hackers Creek, 1 Mile Above its Mouth (See description of stream). Here the valley walls are in the Conemaugh Series.............................. 44
V.—Lower Pittsburgh Sandstone Cropping Along Road Leading Down Bingamon Creek, 1 Mile Eastward from Peora........ 64
VI.—Lower Pittsburgh Sandstone and Pittsburgh Limestones Cropping Along the W. Va. Short Line Railroad grade, 2 Miles North of Clarksburg............................... 224
VII.—Quarry Near the Summit of Hill at Byron, Harrison County, in Connellsville Sandstone............................ 230
VIII.—Effect of Shot on a Fifty-foot Sand Oil Well in Shinnston Pool—Hartley Heirs No. 1 Well.......................... 278
IX.—Stout Oil Field and Farm on which First Well was Drilled. Another view of the Topography of the Dunkard Series..... 320
X(a).—Greenbrier Oil Field and Topography of the Dunkard Series.. 368
X(b).—Same as above.. 368
XI.—Another View of the Stout Oil Field and Topography of the Dunkard Series.. 400
XII.—View of the Shinnston Oil Field on a Branch of Mudlick Run, and the Topography of the Monongahela Series........ 432
XIII.—Shinnston Oil Field on Coons Run. Topography of Monongahela Series in Background, and Conemaugh Series in Immediate Foreground.................................. 448
XIV.—Famous Swiger Oil Well (618), Represented by Derrick near Middle of Sky-line. The Steel-tube Derrick on the Left is the Great Whiteman No. 2 Well (619).................... 464
XV.—View Looking North from Adamsville, Showing Proximity of Oil Wells on Coons Run, and Topography of Monongahela Series 480

Facing Page
XVI.—Effect of Shot on the Paugh Gas Well (704) in Fifth Sand, Located 2 Miles Southeast of Byron. Dry Sand Loosened by Shot is Being Blown Out with the Gas.................... 496
XVII.—Steel-tube Derrick Used by the South Penn Oil Co.—McIntyre Well (356), 2½ Miles South from Rinehart—and Dunkard Series Topography.. 512
XVIII.—View Showing Tipple and Coke Ovens of the Byron Mine of the Hutchinson Coal Company—No. 80 on Map......... 576
XIX.—Plant and Town at the Pinnickinnick (No. 25) Mine of the Consolidation Coal Co. near Clarksburg—No. 65 on Map. Also Topography of the Monongahela Series................ 592
XX.—Steel Tipple at the Owings (No. 32) Mine of the Consolidation Coal Co., 2.5 Miles Southeast of Shinnston—No. 25 on Map—Also Topography of the Monongahela Series.......... 608
XXI.—Plant and Town of the Enterprise (No. 49) Mine of the Consolidation Coal Co. at Enterprise—No. 13 on Map—Also Topography of the Monongahela Series.................... 624
XXII.—High Grade Brick Company Pit, Showing Coal, Clay, and Shale, Clarksburg.. 644
XXIII.—Jackson Quarry in Arnoldsburg Sandstone at Clarksburg, Harrison County.. 648
XXIV.—Fred Flowers Quarry in Lower Sewickley Sandstone, near Gore, 2 Miles North of Clarksburg. (See Gore Section).. 652
XXV(a).—Wagner Quarry in Connellsville Sandstone, near Byron, Harrison County.. 658
XXV(b).—Smith Quarry in Connellsville Sandstone, near Byron, Harrison County.. 658

Figures.

1. Map Showing County Reports Published and Under Preparation, also New Topographic Quadrangles.................... XIV
2. Map Showing Location of the Doddridge-Harrison Area...... XIV
3. Diagram Showing the Relative Position of the Coals in the Doddridge-Harrison Area.................................. 566
4. Showing Approximate Area of Available Redstone Coal in the Doddridge-Harrison Area.................................. 570
5. Showing Approximate Area of Available Pittsburgh Coal in the Doddridge-Harrison Area.............................. 574

AUTHOR'S PREFACE.

As with other similar reports prepared by the writer, the main purpose has been to emphasize the most prominent features of the geology of Doddridge and Harrison counties, and to state the facts so that they can be easily understood both by the residents of the area and State and geologists in general, without conflicting with scientific truths.

The ultimate purpose of this report is to assemble the present knowledge, including a large amount of unpublished data collected by the writer, his assistant and others in the field, not only of the general geology of the two counties, but a brief history of their settlement and growth, along with a description of their physiography and economic resources in the way of minerals and soils, and to present the facts in a form convenient to those who are interested in their study either for scientific purposes or development.

The report gives (1) a brief history of the counties and their development; (2) a study of their drainage systems and other surface features; (3) the geologic structure with a contour map of the top of the Pittsburgh coal; (4) four chapters on their general geology and detailed stratigraphy, with a map showing the outcrop of the different divisions of the rock column, according to the generally accepted classification of American geologists; (5) a description of the oil and gas fields therein, with suggestions for their future development, along with a map showing the accurate location of the oil and gas wells and dry holes; (6) their minable coals, with a table showing the chemical composition, calorific value and fuel ratio, and with a summary exhibiting the approximate available tonnage in both counties; (7) their clays, road material, building stones, forests, and carbon black industry of both counties; (8) a chapter on the soil and its products with suggestions for increasing the soil fertility; and (9) an appendix showing railroad levels therein.

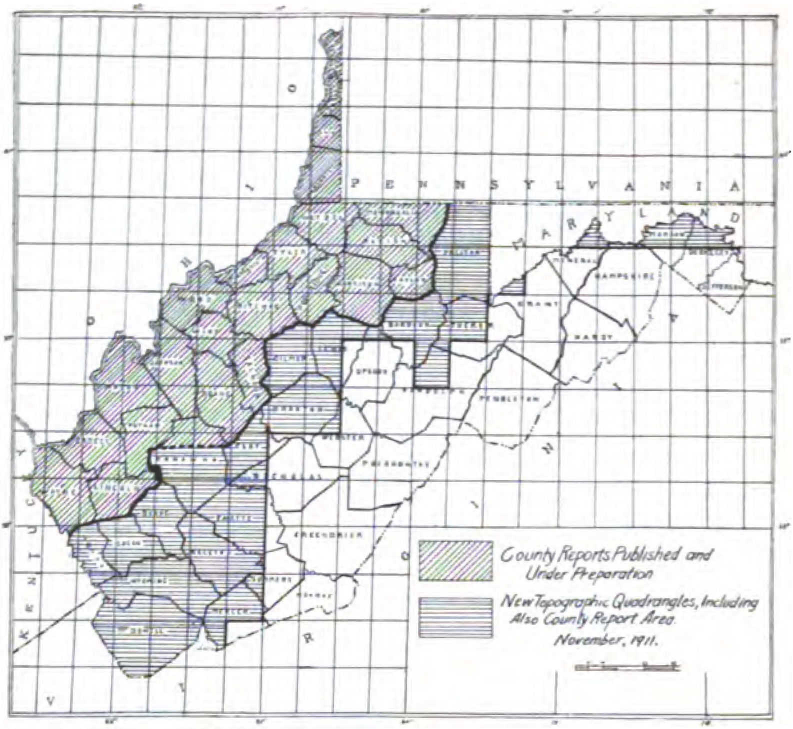

PENNSYLVANIA
MARYLAND
OHIO
KENTUCKY
VIRGINIA
County Reports Published and Under Preparation
New Topographic Quadrangles, Including Also County Report Area.
November, 1911.

Figure 1.

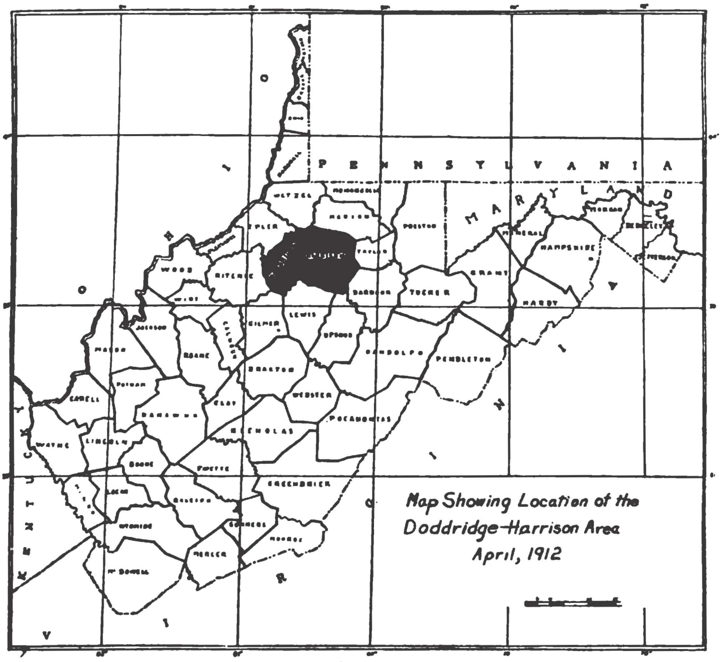


Figure 2.

Special attention is called to the structure map accompanying this report, whereon are shown by means of contour lines the tidal elevation of the Pittsburgh coal horizon at all points of the area. These contour lines, separated by 25 feet in elevation, exhibit at a glance the approximate position of the horizon of this great coal bed, the shape and location of the anticlines and synclines, and the direction of the *dip* and *strike* of the rock strata at any point, a knowledge of which is of great value not only for the further development of the oil and gas pools therein, but also for the future mining of the several coal seams where the latter are of minable thickness, purity and regularity. Special attention is also called to the several areas outlined by the writer as "Prospective Oil and Gas Territory," and page references in the Index under this heading by magisterial districts.

The chapters on the general geology and detailed stratigraphy, though quite technical, give a large fund of data about the formations of the Dunkard, Monongahela and Conemaugh series of the Upper Carboniferous group of rocks. Therein many errors of correlation in former State reports are corrected, the writer ever keeping in mind the general and accepted classification of the rock strata which permits comparison with the formations in other portions of West Virginia, and in other States. Attention is called to the paper in Chapter VII on the "Fossil Fauna" of the Ames limestones in Harrison county by J. W. Beede of the University of Indiana.

The chapter on coal gives the thickness, character and general distribution of the several minable beds, along with an approximate estimate of the available area and tonnage of each vein with a final summary of the total available coal for both counties. The commercial mines are referred to in the table of analyses therein by serial numbers, the same corresponding to numbers assigned to the symbol designating the accurate location of the mine on the map referred to above.

Chapter X gives a description of the clays and the clay industry, road materials, building stone, forests, and carbon black industry, along with an interesting paper by Godfrey L. Cabot, Boston, Mass., on the history and development of the latter industry.

The final chapter on the soil and its products, prepared by Charles N. Mooney and W. J. Latimer, of the Bureau of Soils of the Department of Agriculture, both well trained and versed in their profession, cannot fail to interest the progressive farmers therein.

Three maps of the entire area accompany this report in a separate cover, one of which shows by appropriate symbols the character of the surface, the roads, streams, railroads, etc.; another, by the same means, the general and economic geology, with several items of special economic interest; and the third, in a similar way, the character, classification and distribution of the soils.

The writer and his assistant, David B. Reger, spent the field season of 1910 in gathering data for this volume, and opportunity is here taken to mention that the accurate, painstaking and faithful discharge of all duties assigned to Mr. Reger, both in the office and in the field, has been of great assistance in the completion of this report.

Much valuable aid and assistance was given by residents of the area, as well as by officials of the several companies engaged in the development of the oil, gas and coal fields therein. Due credit and acknowledgment have been given in the text for all such data obtained.

The chemical analyses and heat determinations were made in the Survey laboratory by Jan B. Krak, Assistant Chemist, under the supervision of B. H. Hite, Chief Chemist.

The writer also takes opportunity to express his obligations to I. C. White, State Geologist, whose writings and suggestions have added greatly to the value of the report.

RAY V. HENNEN.

Morgantown, W. Va., April 19, 1912.

ERRATA.

Page 7, population given for Grant district should be for Greenbrier, and that for Grant was in 1910, 2067; in 1900, 2150; and in 1890, 2067. Totals for county are correct.

Page 69, line 9 from top, for "Carboniferous", read Corniferous.

Page 250, line 4 from top, for "Orten", read Orton.

Page 298, the wrong record is tabulated under No. 224.

Page 434, under No. 342, "L. E. Bennett No. 1" should read L. E. Bartlett No. 1.

PART I.

The History and Physiography of the Doddridge-Harrison Area

CHAPTER I.

THE HISTORICAL AND INDUSTRIAL DEVELOPMENT.

LOCATION AND HISTORY.

The portion of the State of West Virginia discussed in detail in this report, includes the area lying 25 miles north of the geographical center of the State, as represented by Doddridge and Harrison counties. It lies between the parallels of 39° 00′ and 39° 30′ North latitude, and the meridians 80° 00′ and 81° 00′ West longitude from Greenwich. The two counties include an area of 739.46 square miles as follows: Doddridge, 321.61; and Harrison, 417.85 square miles.

HISTORY OF TRANSPORTATION.

Water Ways.

West Fork River.—The West Fork of the Monongahela river and its tributaries within the area under discussion were used in the early days in transporting timber in log form to the accessible mills along their banks. The river has no locks and dams above Fairmont, W. Va., hence it is too shallow during a great portion of the year to be navigable for boats of sufficient size to carry passengers and freight on a commercial scale.

Steam Railroads.

Baltimore & Ohio (Southwest) Railroad.—This railroad (B. & O.) was one among the first built in the United States, and its Parkersburg Branch was completed in the year 1857. It crosses both counties in an east and west direction, dividing them into two nearly equal parts. It is the main line for through trains for the Baltimore and Ohio system between New York and St. Louis, and for this reason has both a large freight and passenger traffic. The road is also one of the main outlets for the immense tonnage of coal mined from the Pittsburgh bed in Harrison county.

W. Va. & Pittsburgh Branch—B. & O. R. R.—This branch of the Baltimore and Ohio Railroad was commenced in 1879 by Hon. J. N. Camden and completed in 1890. It is now 121 miles in length and extends from Clarksburg southward to Richwood in southeastern Nicholas county. The road was sold by Mr. Camden to its present owners in 1899. From Clarksburg it follows along the east bank of the Monongahela river south to the Lynch mines at the mouth of Browns creek, and thence up the latter stream to its head; thence southwest along a branch of Lost creek, Bonds run, McKinney run and Maxwell run to the river again one mile and a half north of Weston, 15½ miles of the line being in Harrison county, This railroad is the main outlet for the great timber regions of Nicholas, Webster, and Braxton counties, as well as for the several coal mines of Harrison county south of Clarksburg.

Monongahela River Branch—B. & O. R. R.—This branch of the Baltimore & Ohio Railroad System was built in the year 1890 by Hon. J. N. Camden and later (1900) sold to its present owners. It is 32.1 miles in length and extends from

Fairmont to Clarksburg. In Harrison county it follows along the east bank of the Monongahela river, from which stream it has received its name. It has an immense freight traffic from the several mines in the Pittsburgh coal bed along both sides of the river.

W. Va. Short Line Branch—B. & O. R. R.—This branch of the Baltimore & Ohio Railroad extends northwest from Clarksburg, across Harrison and Wetzel counties to the Ohio river at New Martinsville for a distance of 59.6 miles, and leaves the boundaries of Harrison county 23.5 miles northwest from Clarksburg. The construction of this road was begun about 1900 and finished in 1902 by H. H. Rogers of New York City and Prof. T. M. Jackson of Clarksburg, W. Va. It was sold to its present owners in 1902, and is a very important connecting link, aiding very much in the development of the oil and gas fields of northwestern Harrison and southeastern and central Wetzel counties. It will also play a very important part in the future development of the coal fields of northwestern Harrison county.

Electric Railroads.

In addition to the above mentioned railroads on which steam is used as the motive power, there are three other railroads on which electricity is used for traction purposes. The most important of these is the one extending mostly along the west bank of the Monongahela river between Clarksburg and Fairmont, leaving the west bank of this stream only at two or three points to cut off wide bends of the river. This road has a very heavy passenger traffic, and is owned by the Fairmont and Clarksburg Traction Company.

Another electric railroad owned by the same Company runs from Clarksburg westward to Wilsonburg for a distance of 3.5 miles, while another runs eastward from the former place via Industrial to Bridgeport, a distance of 5 to 6 miles.

A fourth electric railroad owned by this Company is now building southwest from Clarksburg to West Milford in Harrison county with Weston as its future terminus. A trolley line is also contemplated between Clarksburg and Sistersville via Sedalia, Shirley and Middlebourne. All these trolley lines contribute very much to the general growth and prosperity not only of the city of Clarksburg, but also of the farming regions which they traverse.

Highways.

In the early history of Doddridge and Harrison counties the value of good roads was appreciated to a greater degree than at the present time. This condition has largely been caused by the change from the old stage coach and freighters to the steam railroad and electric trolley lines. However, the advent of the automobile has rapidly reawakened a new interest in public highways and their needs.

Northwestern Turnpike.—The Northwestern turnpike crosses the two counties in an east and west direction via Tollgate, Greenwood, West Union, Smithton, Morgansville, Salem, Bristol, Wolf Summit, Wilsonburg, Adamston, Clarksburg, Bridgeport, Pruntytown and Grafton. In the History of Harrison County, page 252, Henry Haymond has the following to say concerning the construction and early operation of this road:

"In 1827 a charter was granted to the Northwestern Turnpike Company to construct a turnpike road from Winchester to Parkersburg by the way of Romney and Clarksburg, the State being a large stockholder.

"In 1831 the State practically assumed charge of the construction of the road which reached Clarksburg in 1836, and where it passes through the town is still known as Pike Street.

"The chief engineer of the road was Colonel Claudius Crozet, a French engineer who was said to have been a soldier in the wars of Napoleon. He was assisted by Charles B. Shaw.

"In 1848 the State appropriated $60,000.00 for macadamizing the road from the Valley River to Parkersburg.

"The distance from Winchester to Parkersburg is given at 236¾ miles, of which 8¾ miles was in Maryland. The cost of construction was given at $400,000.00.

"The building of this road was looked forward to with the highest anticipation by the people living along its course, as it gave them a much better outlet to the east than they had ever had before.

> **"Stage lines were put on, tavern stands opened, mails were carried, and connections made at Parkersburg with steamboats. * * * * ***
>
> **"The Clarksburg merchants rode on horseback to Baltimore generally making the trip in six days. Wagons hauling 4000 pounds of goods were about fifteen days on the road from Baltimore, the bills of lading allowing 20 days for the trip. The round trip from Clarksburg to Baltimore was considered to require 30 days. Freight rates were from 2½ to 3 cents per pound. * * * * ***
>
> **"The driver of the stage coach was an important personage along the road, and the arival of the coach at a town always caused a crowd to assemble to view the passengers and hear the news. * * * * ***
>
> **"Along the line of these roads there was considerable opposition to the building of railroads, the argument being used that the railroad would carry all the passengers and live stock, which would close all the taverns and that there would be no market for provisions or grain."**

During the summer of 1911 this old turnpike was being macadamized over again between Clarksburg and Salem.

Clarksburg & Philippi Turnpike.—The Clarksburg & Philippi turnpike extends southward from Clarksburg to Philippi in Barbour county via Grassland. It is only a dirt road. Its construction was authorized by the State of Virginia on March 13, 1849, with an appropriation of $6,000 for that purpose, of which $5446.25 was expended, according to C. W. May in Vol. I, Record of Suit, Virginia vs. West Virginia, page 479.

Shinnston & Middlebourne Turnpike—This road extends from Shinnston westward across Harrison and Doddridge counties via Lumberport, Dola, Wallace, and Rinehart. It is also only a dirt road and becomes almost impassable during the winter months due to the heavy haulage incident to the development of the oil and gas fields in this region.

The two counties are traversed by many other highways other than those mentioned above, nearly all of which are merely dirt roads.

GENERAL DESCRIPTION.

DODDRIDGE COUNTY.

Doddridge county lies immediately west of Harrison county, and is bounded on the north by Wetzel and Tyler: on the west by Tyler and Ritchie; and on the south by Ritchie, Gilmer and Lewis. -

Its area given by districts as computed from the accurate topographic sheets of the U. S. Geological Survey is as follows:

Districts.	Sq. Miles.
McClellan	62.99
Grant	44.85
West Union	46.98
Central	27.80
Southwest	30.79
Cove	25.68
New Milton	49.23
Greenbrier	33.29
Total	321.61

The general surface of the county varies in elevation from 725 feet above tide near the mouth of Arnolds creek, 4.5 miles northwest from West Union, to 1600 feet above tide at the summit of a high knob on the Doddridge-Harrison county line, 2 miles S 60° E from Sedalia P. O., a range in elevation of 875 feet.

The population in 1900 was 13,689 of which 13,663 were white, 25 colored, and 129 foreign born. The census of 1910 gives the population as 12,672, or a loss of 1017. This decrease in population in the county is no doubt due to the fact that Doddridge is strictly an agricultural region with no coal mines and other large public works to hold the farmer boys of the region at home. Again it has finally been ascertained that her steep hillsides are better adapted to grazing than to tillage, hence there is not the demand for labor as formerly. It is also true that a grazing region will not support as large a population as one adapted to tillage.

The following table shows the changes in the population of Doddridge county by districts during the last 20 years as given by the census of 1910:

	Population.		
Districts.	1910	1900	1890
Central	1075	1294	1383
Cove	609	843	....
Grant	2067	2150	2067
McClellan	1398	1696	1655
New Milton	1295	1588	1592
Southwest	669	943	1492
West Union	2659	2095	1724
Totals	12672	13689	12163

Doddridge county began its existence, according to V. A. Lewis[1], on February 4, 1845, having been formed by legislative enactment from parts of Harrison, Tyler, Ritchie and Lewis, and named in honor of Philip Doddridge, a distinguished lawyer of Brooke county, Virginia, in the early part of the 19th century. The act creating the county fixed the county seat at West Union.

The farmers of this portion of the State are engaged in raising corn, wheat, oats, hay, potatoes, garden vegetables, apples, beef cattle, sheep and poultry. Since the year 1892 the county has produced large quantities of petroleum and natural gas, and for this reason a large number of its farm owners have enjoyed an annual rental of $1.00 and upwards an acre until drilling either stopped the same or increased it in another form from the sale of these products.

The quality and character of the soil as well as its products will be discussed in another chapter of this report, as also the mineral wealth in the line of coal, oil, and gas.

The State Auditor gives the following property valuations for Doddridge county for the year 1910:

	Assessed Valuation.	**State Tax.**	**State Road Tax.**
Real Estate	$ 7,362,058.00	$3312.93	$ 736.21
Personal Property	3,230,073.00	1453.53	323.01
Totals	$10,592,131.00	$4766.46	$1059.22

---

[1] History of West Va., page 685; 1889.

No State tax is assessed for school purposes, since each magisterial district makes its own assessment for maintenance of schools, both teachers' and building fund.

The total assessed valuation for all kinds of property for the year 1910 is only about one-fifth that for Harrison county. The January 1911 session of the State Legislature abolished the special State Road tax.

Several small towns are scattered over the county, the most important of which are located along the Baltimore & Ohio Railroad. It is also well supplied with churches and public schools. The most important towns are West Union, Centerpoint, Central Station, Smithton, Morgansville, Greenwood, New Milton and Big Isaac.

West Union.

West Union, the county seat and largest town in the county, is located along Middle Island Creek on the Baltimore & Ohio Railroad. According to Lewis[2] the town was incorporated by an act of the Assembly of Virginia on March 14, 1850. By the act creating the county it was made the county seat, and the first court was required to be held at the house of Nathan Davis at that place.

The population of the town in 1900 was 623, but the census of 1910 reports it as 779, or a gain in the last decade of 25 per cent.

Ideal Window Glass Company.—This company manufactures hand blown window glass. The plant is located a short distance east from West Union along the railroad, and was established in 1906. It has a 24 blower tank and employs 125 men, giving it a capacity of about 1500 boxes a week. Mr. C. P. Zenor is Manager, and the head office is located at West Union.

Central Station.

Central Station, the second town of importance in Doddridge county, is located in the western portion of the latter

---

[2] History of West Va., page 686; 1889.

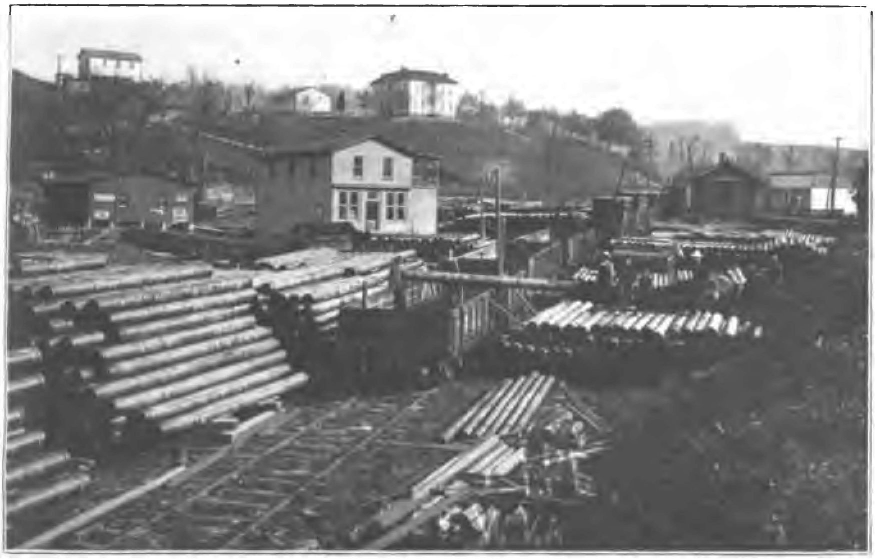


PLATE II (a).—Handling Pipe at Tollgate fcr a large natural gas line for this region.

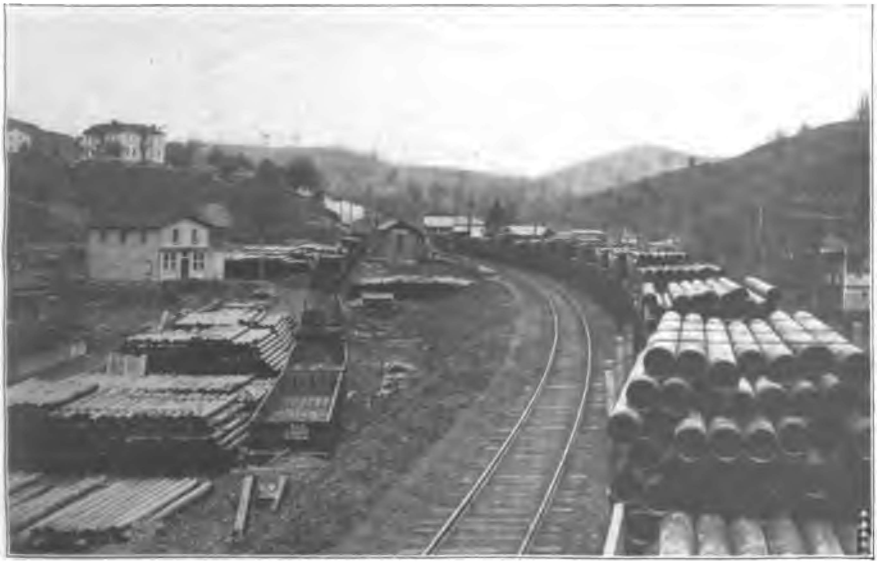


PLATE II (b).—Same. Also Topography of the Dunkard series.

area, 2½ miles west from West Union, and is so named for the reason that it is situated near the midway point of the Grafton-Parkersburg division of the Baltimore & Ohio Railroad. Nearly all trains stop there for water. In 1900 it had a population of 279, largely employees of the railroad. The census of 1910 gives it only 200.

Morgansville.

Morgansville, the third town of importance in the county, is located just east from the mouth of Morgan run of Buckeye creek on the Baltimore & Ohio Railroad, 6 miles east from West Union. It is located near the crest of the Arches fork anticline, and for that reason is in the midst of a great gas field. In 1900 its population was 209. The census of 1910 gives it 265.

Centerpoint.

Centerpoint is a small town located in the northern portion of Doddridge county on the waters of McElroy creek, between the mouths of Pike and Talkington forks. In 1900 it had a population of 189, but the census of 1910 gives it 195. In the early days of the oil development immediately to the northwest it was quite a thriving little village. It is the fourth town in size in the county.

Smithton.

Smithton is located on the north bank of Middle Island creek, one-third mile northwest from the mouth of Buckeye creek, on the Baltimore & Ohio Railroad. It is surrounded by the same great gas field as Morgansville, but is located one mile and a half northwest from the crest of the Arches Fork anticline. In 1900 its population was 110. The census of 1910 gives it 201.

Greenwood.

Greenwood is located in the extreme western portion of Doddridge county on the Baltimore & Ohio Railroad. Its population in 1900 was 109. The census of 1910 gives it 131.

New Milton.

New Milton is a small rural village located near the central portion of the county, 7 miles southeast from West Union, on the east bank of Meathouse fork of Middle Island creek. It is in the center of a fairly rich agricultural region In 1900 its population was 86. The census of 1910 gives it 77.

Big Isaac.

Big Isaac is another small rural village located in the extreme eastern point of Doddridge county. It is situated at the western edge of the great Fifth Sand oil belt of Harrison county. Its population in 1900 was 81. The census of 1910 gives it only 77.

HARRISON COUNTY.

Harrison county lies immediately east from Doddridge, and is bounded on the north by Wetzel and Marion counties; on the east by Taylor and Barbour; and on the south by Upshur and Lewis. V. A. Lewis[3] has the following to say concerning the formation and early history of Harrison county:

> "Harrison was formed from Monongalia by an act of Assembly passed May, 1784, which provided that: 'From and after the 20th day of July next the county of Monongalia shall be divided into two distinct counties by a line beginning on the Maryland line at the Fork Ford on the land of John Goff; thence down the said creek to Tygarts Valley Fork of the Monongahela river; thence down the same to the mouth of West Fork river; thence up the same to the mouth of Bingamons creek; thence up said creek to the line of Ohio

---

[3] History of West Va., page 543; 1889.

county; and that part of the said county lying south of the said line shall be called and known by the name of Harrison.'

"Benjamin Harrison, in honor of whom the county was named, was a native of Charles City county, Virginia, one of the signers of the Declaration of Independence, a Governor of Virginia from 1781 to 1784, and the father of General W. H. Harrison, President of the United States.

"The act creating the county provided that the first court should be held at the house of George Jackson at Bush's Fort on Buckhannon river.

"The early settlers suffered severely during the continuance of the French and Indian wars. To tell the story would be to write a volume. Around Nutter's Fort, where Clarksburg now stands, and West's Fort, near the present site of the village of Jane Lew, were enacted many of the scenes in the drama of savage warfare."

The present area of Harrison county shows a great reduction from that called for in the boundaries outlined above. Its area as computed from the accurate topographic sheets of the U. S. Geological Survey by magisterial districts, is as follows:

Districts.	Sq. Miles.
Sardis	49.45
Ten Mile	50.57
Union	56.74
Eagle	45.11
Clay	37.08
Coal	23.05
Clark	23.95
Simpson	47.59
Grant	42.73
Elk	41.58
Total	417.85

The general surface of the county varies in elevation from 880 feet above tide at the mouth of Bingamon creek on the northern edge, to 1800 feet above tide near the summit of a high knob in the southeastern corner of the county, located 2 miles South 60° East from Johnstown, or a range in elevation of 920 feet.

In 1900 the county had a population of 27,690 of which 26,435 were white, 1252 colored, and 821 foreign born. The census of 1910 gives the population as 48,381, or a gain of 20,691. This great increase of 74.7 per cent in the last decade is due to the rapid development of the coal mining industry and the industrial growth of the city of Clarksburg.

The following table shows the changes in population during the last 20 years of Harrison county by districts as given by the census of 1910:

	Population.		
Districts.	1910	1900	1890
Clark	11084	4097	2956
Clay	4909	3162	2025
Coal	12335	4508	2802
Eagle	3692	2515	2123
Elk	1103	1321	1470
Grant	2512	1727	1650
Sardis	3038	2621	2323
Simpson	3141	1704	1777
Tenmile	4493	3754	2373
Union	2074	2281	2420
Totals	48381	27690	21919

The above table shows that the greatest growth has taken place in Coal and Clark districts, in both of which the city of Clarksburg is located. Elk district, which is purely a farming region with no commercial coal mines and little oil and gas development, shows a gradual decrease in population.

The farming land of Harrison county is finely adapted both to tillage and grazing; in fact, it is one of the leading counties in the State for such purposes. It is also one of the richest counties in the State in the production of petroleum and natural gas, and its pools of these hydro-carbons are still undergoing development. Its principal products are corn, wheat, oats, hay, beef cattle, sheep, poultry, coal, petroleum, natural gas, and manufactured articles, such as coke, carbon black, glass ware, tin plate, stone ware, and brick.

The quality and character of the soil and its products, as well as the mineral wealth, will be discussed in detail in subsequent chapters of this report.

The State Auditor gives the following property valuations for Harrison county for the year 1910:

	Assessed Valuation.	State Tax.	State Road Tax.
Real Estate	$34,630,501.00	$15,583.73	$3463.05
Personal Property	15,325,955.00	6,896.68	1532.60
Total	$49,956,456.00	$22,480.41	$4995.65

No State tax is assessed for school purposes. Each district makes its own assessment for maintenance of schools, both teachers and building fund.

The total assessed valuation for all kinds of property ($49,956,456) is almost five times that for Doddridge, and ranks Harrison the second richest county in the State, Ohio county being first with a total assessed valuation in 1910 of $72,919,625.00. The fine farms, the large oil and gas production, and the great development of its coal mines all contribute very much to the riches of Harrison county.

The towns of this county are as follows: Clarksburg, Salem, Shinnston, Adamston, Lumberport, Bridgeport, Wilsonburg, Mt. Clare (Byron), Wallace, Bristol, Enterprise, Meadowbrook, Glen Falls, Wolf Summit, Lost Creek, West Milford, Sardis, Jarvisville, Brown, Quiet Dell, Rockford, Johnstown, Goodhope, Dola, Wyatt, Romines Mills, Benson, Mineral, Gypsy, Farnum, Viropa, Jimtown, Peora, Oral, Lynch (Maken), and Rinehart. Several of these are small coal mining towns with only the usual company store and homes for miners and their families.

A brief description of the most important towns will now be given.

Clarksburg.

Clarksburg, the largest and most important town in the Doddridge-Harrison area, is located near the central portion of Harrison county on the east bank of West Fork river at the mouth of Elk creek. It is mostly built on high terrace, or old erosion level of these two streams. The first settlement was made at this place in 1773, concerning which Withers[4] has the following to say:

> "On Elk and in the vicinity of Clarksburg there settled Thomas Nutter, near to the Forge-mills—Samuel Cottrial on the east side of the creek and nearly opposite to Clarksburg—Sotha Hickman, on the west side of the same creek, and above Cottrial—Samuel Beard at the mouth of Nanny's run—Andrew Cottrial above Beard, and at the farm now owned by John W. Patton—Daniel Davisson, where Clarksburg is now situated, and Obadiah Davisson and John Nutter on the West Fork; the former near to the old Salt works, and the latter at the place now owned by Adam Hickman, Jr."

---

[4] Chronicles of Border Warfare by A. S. Withers, page 127; 1908.

During the French and Indian wars the early settlers in this vicinity suffered severely from marauding expeditions by the Indians. The last attack made by the latter occurred in the year 1778. V. A. Lewis[5] gives the following account of the same:

> "The last appearance of the Indians on the waters of West Fork in the year 1778, was at the house of Samuel Cottrial, near the present town of Clarksburg. During the night considerable fear was excited both at Cottrial's and Sotha Hickman's, on the opposite side of Elk creek, by the continued barking of the dogs, that Indians were lurking near, and in consequence of this apprehension, Cottrial, on going to bed, secured well the doors and directed that no one should stir out in the morning until it was ascertained that there was no danger threatening. A while before day, Cottrial, being fast asleep, Moses Coleman, who lived with him, got up, shelled some corn, and giving a few ears to Cottrial's nephew with the direction to feed the pigs around the yard, went to the hand-mill in an out-house and began to grind some of the corn. The little boy being squatted down shelling the corn, found himself suddenly drawn on his back and an Indian standing over him, ordering him to lie there. The savage then turned toward the house where Coleman was, fired, and as Coleman fell, ran up to scalp him. Thinking this a favorable time for him to reach the dwelling house, the little boy sprang to his feet, and running to the door, it was opened, and he was admitted. Scarcely was it closed after him when one of the Indians with his tomahawk attempetd to break it open. Cottrial fired through the door at him and he went off, followed by his companions, several in number, who had been concealed near the house."

In his History of West Virginia, pages 546-547, Lewis further says the following about Clarksburg :

> "Clarksburg was established by legislative enactment in October, 1785, when the following trustees were appointed: William Haymond, Nicholas Carpenter, John Myers, John M'Ally and John Davisson. December 30, 1809, the following additional trustees were appointed: Benjamin Wilson, Jr., James Pindall, John G. Jackson, Jacob Stealy, Daniel Morris, Alexander F. Lanham and Allison Clarke. At the May term of the county court, 1810, commissioners were appointed to contract for the building of a court house on a lot given by Benjamin Wilson, Jr., for that purpose, in the town of Clarksburg. Three commissioners contracted with Allison Clarke, John Smith and Daniel Morris to erect the building at a cost of $37,000.00, but after considerable work had been performed and $1,200.00 received for the same, a doubt arose as to the legality of removing the seat of justice. To set the matter at rest, the Assembly, January 18, 1811, enacted that the removal should be legal whenever Benjamin Wilson should convey by deed in fee simple the lot to the justices of Harrison county. The town was incorporated March 15, 1849."

---

[5] History of West Va.; pages 543-544; 1889.

The village was named in honor of Geo. Rogers Clark, a famous frontiersman and Indian fighter of the Revolutionary period.

During the last decade Clarksburg has had a very rapid growth both in population and in industrial activity. The census of 1900 gives the population as 4,050, but that of 1910 gives it 9,201, or a gain of 5,151. This is a growth of 127 per cent, and ranks Clarksburg as the eighth city in population in the State, having 510 less people than Fairmont, the seventh city of the State, and only 51 more than Morgantown, the ninth city of West Virginia.

A short account will now be given of the several industries of Clarksburg and vicinity:

Glass Industries—Clarksburg, next to Morgantown, is the most important glass manufacturing town in the State. Eight different plants are located there, five of which make window glass, and the others miscellaneous articles. All these different concerns have located there during the last 12 years, having been attracted by the low price (4 cents a thousand cubic feet) of natural gas offered for manufacturing purposes to induce plants to locate at that place. A brief account will now be given of each plant.

Clarksburg Glass Company.—This plant is located across the West Fork river from Clarksburg in Adamston, and was established in 1901, according to information furnished Mr. Reger by P. E. Hochstrasser. It has a 36 blower tank, and employs 185 men of which 92 are skilled workmen. Its output is 100,000 boxes a year of hand blown glass. White Rock sand from Terra Alta, West Virginia, is used in making the glass. It makes both window and bent glass.

Peerless Window Glass Company.—This plant is located in the northwestern edge of Clarksburg, opposite the mouth of Limestone run, and was established in 1905. According to Jas. Clelland, General Manager, it is operated by W. R. Jones of Morgantown, W. Va., and has its main office at Columbus, Ohio. It has a 24 blower tank and employs 145 men, manufacturing hand blown window glass exclusively. The capacity of the plant is 2,200 boxes weekly. It consumes

600,000 cubic feet of gas daily. Sand from Sturgisson, Monongalia County, W. Va., is used in making the glass. This sand at the latter point comes from the Upper Connoquenessing sandstone ledge of the Pottsville series of rocks.

Hazel-Atlas Glass Company.—This plant is Clarksburg's largest glass manufacturing concern, and was established in 1900. It makes jelly glasses, beef jars and other glass ware for packing food products, and also snuff bottles. The establishment runs the year round, shutting down only for July 4th and Christmas, and employs 400 people, 200 of whom are skilled workmen. It has an output of 20 car loads weekly of food products glass ware, and 8 car loads weekly of snuff bottles, etc. The sand used in manufacturing the food products glass ware is obtained from the West Virginia and Pittsburgh Sand Company's plant at Berkeley Springs, W. Va., while that used in making the snuff bottles comes from Irvington, Mineral County, W. Va. The limestone used by the concern comes from northern Ohio. All ware is machine blown. The plant has a monthly consumption of 30,000,000 cubic feet of natural gas, hence fuel is quite an item of expense in the operation of this concern as well as in all other glass factories. Thos. Coleman, Jr., Superintendent, is authority for data.

Tuna Glass Company.—This plant is located at Industrial, a suburban town, 1 mile southeast of Clarksburg, and was established in 1907. It manufactures hand-blown window glass exclusively and has a 48 blower tank. According to information furnished Mr. Reger by C. L. Bush, Foreman, this factory employs 375 men of whom 175 are skilled workmen. It has a capacity of 4,500 boxes weekly, and is one of the largest concerns of its kind in the State. Sand from Berkeley Springs, West Virginia, and from Oakland, Maryland, is used in making the glass.

Lafayette Window Glass Company.—This factory is located in Clarksburg and was established in 1899, being the first glass concern to locate in the town or the vicinity. According to A. W. Eshenfelder, Book-keeper, it furnishes employment to 125 men of whom 90 are skilled workmen.

It has a 24 blower tank and makes hand-blown window glass exclusively. The capacity of the plant is 90,000 boxes of glass yearly.

West Fork Glass Company.—This plant is located in the town of Industrial, a suburb of Clarksburg. It has a 36 blower tank and makes hand-blown window glass only. The factory furnishes employment to 180 men of whom 140 are skilled workmen. The output is 12,000 boxes monthly, according to information furnished Mr. Reger by R. R. Koblegard, Bookkeeper. Sand from Terra Alta, Preston county; Sturgisson, Monongalia county; and Martinsburg, Berkeley county, West Virginia, and also from Connellsville, Pa., is used in making the glass.

Travis Glass Company.—This factory is located in Clarksburg, and was established in 1908. It manufactures machine-blown milk bottles, and uses the O'Neil semi-automatic machine. The plant furnishes employment for 175 to 200 men, 50 of whom are skilled workmen. Its capacity is 15 to 16 car loads weekly. H. E. Travis is President of the concern and authority for data.

Clarksburg Opalescent Glass Works.—This plant is located at Industrial, 1 mile southeast of Clarksburg, and was established in 1904. It manufactures artistic and decorative glass by the natural gas process. One furnace is run during the whole year and two, part of the time. The product is hand rollled, and employment is furnished for about 30 men. The output is three tons of glass daily, according to information given Mr. Reger by E. L. Spraker, secretary and treasurer of the Company. Sand from Berkeley Springs, West Virginia, is used in making the glass. No lime is used.

Miscellaneous Industries.—In addition to the several glass plants described above, there are almost a dozen other important factories manufacturing various articles. These will now be described.

Phillips Sheet & Tin Plate Company.—This plant is located in the eastern end of Clarksburg, and was established in 1904. It is the largest single factory in the town, and makes tin and terne plate, and uncoated metal used in the manufacture of metal ceilings and galvanized ware. According to information given Mr. Reger by E. L. Cronmeyer, Superintendent, it is a 12 mill plant with 1,000 employees, 30 of whom are women, and 900 of whom are skilled workmen. Its output is one million 100-pound boxes yearly. Natural gas is used for fuel throughout the plant, requiring 3½ million cubic feet daily.

Graselli Chemical Company.—This Company has a plant located at Graselli, 2 miles southeast from Clarksburg. Its factory was established in 1904, according to Chas. Kester, Chief Clerk, and furnishes employment for 400 people, most of whom are foreigners. It makes zinc spelter exclusively. Natural gas is used for fuel.

National Carbon Company.—The National Carbon Company has a factory located at Graselli, 2 miles southeast from Clarksburg. According to information furnished Mr. Reger by E. B. Jewett, Resident Manager, this plant was established in 1904, and manufactures carbon electrodes. About 140 men are employed, ten per cent of whom are skilled workmen. The output of the plant is 1,500,000 pounds monthly. Gas engines are used in generating electric power for the factory.

Clarksburg Zinc Company.—This plant is located at the northwest edge of Clarksburg and was originally owned by Jos. Loudourette & Company, but since 1907 has been owned and operated by the Clarksburg Zinc Company. It manufactures zinc spelter exclusively into slabs weighing 50 pounds each. Old style retort ovens are used in making the product, and, according to I. L. Briggs, Manager, employment is furnished for 130 men.

Hart Bros. Machine Company.—The oldest manufacturing plant in Harrison county is that owned by Hart Bros. Machine Company near the west end of Pike Street, Clarksburg. It was established in 1852 under the name of Ira Hart. In 1879 it was reorganized under the name of C. M. & J. B. Hart, but in 1897 it was burned, rebuilt and changed to its present name. According to information furnished Mr. Reger by J. B. Hart, the factory employs 45 men, nearly all of whom are skilled laborers. It makes saw-mill machinery and has an output of two mills weekly. According to Mr. Hart, it made the first threshing machine, the first mowing machine, and the first locomotive built in the State.

Clarksburg Foundry & Casting Company.—This company has a plant at Clarksburg which was established in 1907. According to information given Mr. Reger by C. G. Jewett, Manager, employment is furnished for 18 people, ten of whom are skilled workmen. Gray iron and brass castings are manufactured, the plant having a capacity of 1500 to 1800 tons yearly.

Lange & Crist Box & Lumber Company.—This plant was established in 1909 and makes boxes for packing tin plate and for the output of the Phillips Sheet & Tin Plate Company at Clarksburg. Employment is furnished for 20 men, and the output of the plant is about 2,000 boxes daily.

Clarksburg Casket Company.—This factory is located in Clarksburg and was established in 1906. According to data given Mr. Reger by F. L. Wilson, President, it furnishes employment to 13 men and 4 women, 6 of whom are skilled laborers. It manufactures robes, linings and caskets for funeral purposes. Its output is 225 caskets monthly.

A. Radford Pottery Company.—This plant was incorporated in 1903. It manufactures art specialties, fancy wares such as umbrella stands, jardinieres, etc. Employment is furnished for 40 men, 30 of whom are skilled workmen. The clay used in making the ware is obtained from Tennessee, Kentucky and West Virginia. That from the latter is obtained from Hardman Switch near Grafton. The Hardman clay gives good results when mixed with the other clays. H. E. Marquard, Superintendent, is authority for data.

Both the Glen View Brick Company and the Monticello Brick Company plants at Clarksburg will be described on subsequent pages of this report in the chapter on clays, etc.

Star Rig, Reel & Supply Company.—According to the Royal Blue Book of the B. & O. R. R. Co. for 1910, this plant was established in Clarksburg in 1900 and has a capacity of 2,250,000 pounds of rig iron outfits and 7,000,000 pounds of manila cables annually. All lumber and iron used in the manufacture of the articles being obtained from the State of Virginia, while the manila fiber used is obtained from the Philippines. The finished product is shipped to all parts of the globe. Employment is furnished for 32 men and 1 woman, with a pay-roll of $35,000 annually.

Salem.

Salem is situated on the main line of the Baltimore & Ohio Railroad, 13 miles west from Clarksburg and in the extreme western edge of Harrison county. In the History of Harrison County, page 341, Haymond says it was settled before peace with the Indians by a colony of about forty families from Salem, New Jersey. These families consisted of Lippincotts, Maxons, Babcocks, Plumers, Randolphs, and Davises. According to V. A. Lewis[5], it was formerly named New Salem, concerning which he has the following to say:

> "New Salem was made a town by legislative enactment December 19, 1794, on lands of Samuel Fitz Randolph. John Patterson, John Davis, Samuel Lippincott, James Davis, Zebulon Maxon, Benjamin Thorp, Thomas Clayton, William Davis, Jacob Davis, George Jackson, and John Haymond were appointed trustees thereof."

In 1900 the town had a population of 746, but the census of 1910 gives it 2,169, or a gain of 190.7 per cent. This great growth during the last decade has been largely due to the development of the extensive oil and gas fields surrounding the place, and ranks it the second town in the county.

Modern Window Glass Company.—According to information furnished Mr. Reger by Louis Mottet, Secretary for the Modern Window Glass Company, the plant was established during the year 1910, but did not begin operations until January 1st, 1911. It is a 36-pot factory. Only hand blown window glass is made. Employment is furnished for 250 men, 100 of whom are skilled workmen.

Salem Co-Operative Window Glass Co.—This plant was established in 1908, and manufactures window glass exclusively. According to information furnished by the company, it is a 24-pot plant with a capacity of 4½ cars weekly of hand blown ware, and employs 125 persons, all of whom are men, giving an average monthly pay roll of $10,000.00. The plant runs ten months in the year. The sand used in making the glass is obtained from the quarries of the White Rock Sand Co. near Corinth, Preston county, W. Va.

---

[5] History of West Virginia, page 547; 1889.

McBride Lamp Chimney Company.—This plant is located in Industrial at the west edge of Salem, and was established in May, 1907. According to information furnished D. B. Reger by Thos. F. McBride, owner and manager, it employs 21 men with a monthly pay roll of $1,000.00, and has an output of 1200 dozen hand blown chimneys weekly. It is a six shop factory of three men each. The sand used in making the glass is obtained from Berkeley Springs, W. Va.; the lime, from Buckeyestown, Maryland; and the soda ash, from Wyandotte, Mich.

West Virginia Industrial Home for Girls.—This State Institution is located at the western edge of Salem, on a high terrace north of the Baltimore & Ohio Railroad. This Institution was established by an act of the Legislature passed February 18, 1897, and was opened for the reception of girls May 5th, 1899, since which time 303 girls (Sept. 30, 1910) have been received. The Institution was created for the sole purpose of the care and reformation of girls between the ages of seven and eighteen years who may be committed by the proper authorities.

The following data and tables are taken from Vol. I of the W. Va. Board of Control, pages 186, 189, 190, 191, 192, 193, and 194:

"* * * * * * The citizens of Salem gave a farm of 38 acres for the establishment of the Home; the State buying nine acres, making a farm of forty-seven acres, sixteen of which are under cultivation."

STATISTICAL TABLES.

Table No. 1.

Number of girls received into the Home since May 5th, 1899	....	....	303
Number returned as unfit subjects	17	....	....
Number discharged, expiration of time	5	....	....
Number discharged, good behavior	25	....	....
Number discharged, various reasons	116	....	....
Total Number Discharged	....	163	....
Nnmber contracted to parents or relatives	30	....	....
Number contracted for wages	32	....	....
Total Number out in care of the Home	....	62	....
Total Number discharged and contracted	....		225
Total Number remaining in the Home	....	....	78

Table No. 2.

Number in the Home Sept. 30, 1908	....	....	72
Number received during the period	67	....	....
Number paroled during the period	61	....	....
		....	6
Total in the Home Sept. 30, 1910	....	....	78

Table No. 3.

The Counties from which Girls have been committed.

Name	Past Two Years.	Previous	Total
Brooke	0	4	4
Boone	0	1	1
Berkeley	3	2	5
Braxton	4	6	10
Barbour	0	3	3
Cabell	1	4	5
Calhoun	1	1	2
Clay	0	1	1
Doddridge	0	1	1
Fayette	6	8	14
Gilmer	2	0	2
Greenbrier	0	2	2
Grant	0	2	2
Hancock	1	1	2
Harrison	4	15	19
Hampshire	0	2	2
Jackson	0	3	3
Jefferson	0	2	2
Kanawha	5	24	29
Lewis	0	10	10
Marshall	2	9	11
Mingo	4	2	6
Mercer	0	3	3
Monroe	0	1	1
Marion	3	8	11
Monongalia	1	2	3
Mineral	0	3	3
Mason	1	11	12
Nicholas	0	2	2
Ohio	6	29	35
Preston	0	3	3
Roane	1	0	1
Ritchie	3	6	9
Randolph	3	3	6
Summers	0	6	6

Tyler	2	3	5
Taylor	4	7	11
Tucker	0	3	3
Upshur	2	4	6
Wetzel	0	3	3
Wood	8	33	41
Wayne	0	1	1
Wirt	0	1	1
Webster	0	1	1
Total	67	236	303

No girls have been sent to the home from the following counties: Hardy, Logan, Lincoln, McDowell, Morgan, Pleasants, Putnam, Pocahontas, Pendleton, Raleigh and Wyoming.

Table No. 5.

Ages of Girls committed.

Ages	Past Two Years.	Previous	Total
Seven years	0	1	1
Eight years	0	0	0
Nine years	0	7	7
Ten years	6	11	17
Eleven years	3	11	14
Twelve years	9	15	24
Thirteen years	9	29	38
Fourteen years	11	49	60
Fifteen years	18	49	67
Sixteen years	8	34	42
Seventeen years	1	20	21
Eighteen years	1	8	9
Nineteen years	0	2	2
Unknown	1	0	1
Total	67	236	303

Table No. 7.

Population of this Period by Parentage.

Conditions.	Father	Mother	Total
Parents divorced	....	....	7
Parents not living together	....	....	23
Intemperate	14	11	25
Half-orphaned	22	18	40
Step-father	....	....	14
Step-mother	....	....	12
Foster-mother	....	....	1
Both parents dead	....	....	3
Parents own property	....	....	23

Table No. 9.

Population of Sixty-seven entering this Period showing Illiterate Condition.

Number that could not read	9
Number that could read in first reader	12
Number that could read in second reader	4
Number that could read in third reader	11
Number that knew nothing of arithmetic	14
Number that could count to 10	7
Number that could add	9
Number that could subtract	5
Number that could multiply	..
Number that could not write	11
Number that could write a little	9
Number that could write letters	9

Table No. 10.

Population of those entering this Period in General.

From towns	60
From the country	7
Have brothers	52
Have sisters	53
Church members	14
Attended Sunday School regularly	9
Attended Sunday School irregularly	10
Working when committed	19
Not living at home when committed	23
Were in trouble before	8

Table No. 11.

Population by Institutional History.

Have been in jail	6
Almshouses	2
Orphan Asylums	3
Catholic institutions	3
No institutional history	53
Total	67

Table No. 12.

Time of Detention of Girls now in the Home.

Five years in the Home	4
Four years in the Home	4
Three years in the Home	4
Two years in the Home	15
One year in the Home	19
Less than one year in the Home	31
Total	78

"The average time of detention of the girls in the Home is one year, eleven months and sixteen days.

"Eleven of the sixty-seven received this period have brothers in Boys' Reform School.

"The age of the oldest girl committed this period is twenty-two years; the age of the youngest, nine years.

"The average number in the Home this biennial period is seventy three.

"Average age of girls committed, thirteen years and six months."

Shinnston.

Shinnston, the third town in Harrison county in order of population as given by the census of 1910, is located on the east bank of the West Fork river in the northern portion of the county at the mouth of Shinns run. In 1900 the town had a population of 535, but the census of 1910 gives it 1224, a gain of 689, or 128.7 per cent.

Henry Haymond gives the following interesting account concerning the early settlement of this village in his history of Harrison County, pages 344 and 345:

"The land upon which Shinnston now stands was first occupied by members of the Shinn family, who were Quakers from New Jersey. The pioneer was Levy Shinn, who according to the land records located 400 acres on West Fork river adjoining lands of John Wood to include his settlement made in the year 1773, with a preemption right to 1,000 acres adjoining.

"Levy it appears did not remove his family to his homestead for a year or two after making his location. Shortly after doing so he was joined by several members of his family, including two brothers, Clement and Jonathan. There is a family tradition that Levy's lands lay west and south of Shinn's run. Jonathan's extended from the mouth of this run down the river to the south and east, covering the present site of Shinnston, and that Clement's holdings lay south of Jonathan's on a stream called Middle Creek.

"Jonathan willed the land covering the present site of Shinnston to his son Levy, who built the first house in 1802, which is still (1909) standing.

"The first child born in the new settlement was Asa Shinn. The Act of the Legislature establishing the town of Shinnston passed January 22, 1818, enacted:

"That the lots and streets as already laid off on the lands of Asa and Levy Shinn on the West Fork of the Monongahela river in the county of Harrison, be established a town by the name of Shinnston, and that John Righter, Davis Wamsley, Samuel Shinn, John D. Lucas, Benjamin Wood, Joseph Wilson and Jeremiah Roby, Gentlemen, be and they are hereby appointed trustees thereof.

"By an act passed May 26, 1852, Shinnston was incorporated, and the voters were authorized to elect seven trustees with the usual powers of such officers. The Act was not to take effect until ratified by a majority of the voters of the town, and was to include the town 'as the same has heretofore been laid off into lots, streets and alleys.'

"During the war this charter was allowed to lapse and a new one was procured in 1877. The Circuit Court on June 4th, 1877, issued an order incorporating the town of Shinnston under chapter 47 of the code and appointed Albert Shinn, James Jackson and M. J. Ogden, commissioners to hold the first election for officers of the said town."

Shinnston is surrounded by a rich agricultural region, a great coal field and extensive oil and gas pools, all of which have contributed to its remarkable growth during the last decade.

Adamston.

Adamston, the fourth town of importance in Harrison county, is located on the opposite side of West Fork river from the city of Clarksburg, and is generally considered a suburb of the latter place. According to Haymond in the same history referred to above, the town was named in honor of Josiah Adams, who formerly owned the farm upon which the town is situated, and was incorporated October 3, 1903.

It has enjoyed a very rapid growth during the last decade. In 1900 its population was only 316, but the census of 1910 gives it 1200, a gain of 884, or 279.6 per cent.

Lumberport.

Lumberport is the next town in size in Harrison county, and is situated on Tenmile creek, one-half mile from the mouth of the stream and on the W. Va. Short Line Branch of the Baltimore & Ohio Railroad. In his History of Harrison County, page 348, Haymond gives the following account of its incorporation:

> "It appears from an order of the Circuit Court of Harrison County entered on the 18th day of September, 1901, on the chancery side thereof that a certificate under oath of G. D. Griffin, E. D. McCarty, and J. W. Wadsworth was filed that day showing that a majority of all the qualified voters residing in a described boundary have been given in due form of law in favor of the incorporation of the town of Lumberport in the County of Harrison, the said town is incorporated under the provisions of Chapter 47 of the Code of West Virginia.
>
> "And it was ordered that E. D. McCarty, Ed. Boggess and J. W. Wadsworth be authorized to act as commissioners at the first charter election to be held in said town as required by law.
>
> "The officers elected at the first election held in 1901 were J. W. Wadsworth, Mayor; J. E. Boggess, Recorder; and George D. Griffin, Lee Boggess, J. B. Payne, E. D. McCarty and L. M. Harter, Councilmen."

In 1900 the population of Lumberport was only 258, but the census of 1910 gives it 656, a gain of 398, or 154.2 per cent. This large growth during the last ten years is due to the fact that the town is surrounded by a rich farming region, a great coal field, and extensive natural gas pools.

Bridgeport.

Bridgeport is located five miles east from Clarksburg on the Parkersburg & Grafton Branch of the Baltimore & Ohio Railroad. It ranks next in size and importance to Lumberport. In 1900 it had a population of 464, but the census of 1910 gives it 577, a gain of 113, or 24.3 per cent. Haymond[7] gives the following interesting account of its early history:

---

[7] History of West Virginia, page 344; 1910.

"Joseph Davisson, it is claimed, first settled upon the land on which Bridgeport now stands. The exact date of his building his cabin is not known, as the entry omits the date. The certificate from the Commissioners of unpatented lands, which was issued to him in Clarksburg in 1781, states that as the assignee of Benjamin Coplin, he is entitled to 400 acres in Monogalia county, on Simpsons creek, adjoining lands of James Anderson, with a preemption of 1,000 acres of land adjoining thereto.

"As James Anderson, Andrew Davisson, John Wilkinson and John Powers all took up lands immediately surrounding Bridgeport during the years 1771 to 1774, it is presumed that Joseph Davisson joined the settlement about that time.

"Mr. Benjamin Stout, the oldest resident near Bridgeport, says that Joseph Davisson was one of the first settlers near Bridgeport, and owned what was known as the Coplin farm, and the town was located on his land. * * * * *

"The Circuit Court in an order, entered March 21, 1887, sets forth that Jasper N. Wilkinson, Thos. H. Kenney and J. B. Martin who reside in Bridgeport, have caused an accurate map and survey to be made of the territory in Harrison county to be incorporated as the town of Bridgeport and it appearing that at an election held at the office of D. D. Wilkinson on the 28th of February, 1887, a majority of the qualified voters within said territory voted in favor of such incorporation, and that all the provisions of Chapter 47 of the Code of West Virginia have been complied with, the said town is duly incorporated under said Chapter. * * * * *

"The Act originally establishing the town of Bridgeport was passed January 15, 1816, provided: "That 15 acres of land, the property of Joseph Johnson at Simson's Creek bridge in Harrison county as soon as the same be laid off into lots with convenient streets, be established a town by the name of Bridgeport and that Benjamin Coplin, Mathias Winters, Peter Link, John Davisson, David Coplin, Jedediah Waldo and Joseph Johnson be and are hereby appointed trustees thereof."

Bridgeport Lamp Chimney Co.—This plant was established in 1907 and manufactures lamp chimneys, and gas lantern globes. According to information furnished by W. F. Dunkin, Superintendent, it has a daily capacity of 100 boxes containing 6 dozen globes or chimneys each. The ware is all hand blown, and employment is furnished for 50 persons. 36 of whom are men; 2, women; and 12, boys. The plant generally runs 10½ months in the year, shutting down for July and the first half of August. The sand used in making the glass is shipped from Berkeley Springs, W. Va.

West Va. Pottery Company.—Bridgeport has one of the two pottery plants located in the Doddridge-Harrison area; viz., the West Va. Pottery Co. According to information furnished by Gordon B. Late, Superintendent, the plant was first established in 1880 by Gideon Sandusky; later it was run by E. O. Russell. From 1903 to 1907 it was run in partnership by C. H. Warner and Gordon B. Late. On April 15, 1907, it was incorporated under its present name. Employment is furnished for 12 men, 4 of whom are skilled workmen. The plant is run 12 months in the year, and the pay roll averages $500.00 monthly.

This establishment will be discussed further in a subsequent chapter on clays.

Bridgeport, like nearly all Harrison county towns, is surrounded by a rich farming and grazing region, as well as coal fields and natural gas pools.

Gypsy.

Gypsy is a small coal mining town located on the east bank of West Fork river, 2.5 miles below the mouth of Simpson creek. It is connected with Fairmont and Clarksburg by the Monongahela River Branch of the Baltimore & Ohio railroad, as well as by the Fairmont & Clarksburg Electric railroad. The census of 1910 gives its population as 525.

Wilsonburg.

Wilsonburg is a small town located on the main line of the Baltimore & Ohio Railroad, 3½ miles west from Clarksburg. It is also connected with the latter place by an electric railroad whose western terminus is at this point. In 1900 the town had a population of 350, but the census of 1910 gives it 410.

Mt. Clare (Byron Station).

Mount Clare, or Byron Station, is located on the W. Va. & Pittsburgh Branch of the Baltimore & Ohio Railroad, 7 miles south from Clarksburg. It is a coal mining town, and in 1900 had a population of 319, but the census of 1910 gives it 325.

Wallace.

Wallace is located on the W. Va. Short Line Branch of the Baltimore & Ohio Railroad about 21 miles by rail northwest from Clarksburg. In 1900 it had a population of 248, but the census of 1910 reports it as 375. During the last decade the town has enjoyed a rapid growth, due to the development of the oil and gas fields in the vicinity. It has probably fallen off in population during the last three or four years, owing to a decline in drilling operations in this locality.

Bristol.

Bristol is a small town located on the main line of the Baltimore & Ohio Railroad, 2 miles east from Salem, and 11 miles west from Clarksburg. It has also increased considerably in population during the last decade for the same reason as that given for Salem and Wallace. In 1900 it had a population of 232. The census of 1910 gives it the same number.

Enterprise.

Enterprise is a small coal mining town located on the Monongahela River Branch of the Baltimore & Ohio Railroad, in the northern edge of Harrison county, 3 miles northeast of Shinnston. In 1900 it had a population of 115, but the census of 1910 gives it 365.

Meadowbrook.

Meadowbrook is a small town located on the Monongahela River Branch of the Baltimore & Ohio Railroad on the east bank of the Monongahela river at the mouth of Simpson creek. It is also a coal mining town. During 1910 a large zinc spelter plant was built a short distance (one-half mile) southwest from this place. In 1900 the town had a population of 196. The census of 1910 gives it 75.

Glen Falls.

Glen Falls is a small coal mining town located on the Monongahela River Branch of the Baltimore & Ohio Railroad, on the east bank of the Monongahela river, 2 miles northeast of Clarksburg. It probably receives its name from Falls run, emptying into the river just above the town. In 1900 it had a population of 233, but the census of 1910 gives it 247.

Wolf Summit.

Wolf Summit is a small town located on the main line of the Baltimore & Ohio Railroad, 7 miles west from Clarksburg. It is located in the midst of a great oil and gas field and for that reason once had a "mushroom" growth characteristic of oil field towns of other portions of the State. In 1900 it had a population of 183. The census of 1910 gives it 200.

Lost Creek.

Lost Creek is situated on the W. Va. & Pittsburgh Branch of the Baltimore & Ohio Railroad, 12 miles south from Clarksburg. This place is situated in a rich agricultural region and in the midst of a great gas field. It takes its name from the creek on which it is located. In 1900 it had a population of 160. The census of 1910 gives it 225.

West Milford.

West Milford is a small rural village located on the north bank of West Fork river, 6 miles southwest of Clarksburg. It is situated in the midst of the best farming region of Harrison county, and the latter is one of the best agricultural counties in the State. Like all strictly agricultural towns in West Virginia, it has not grown much during the last decade. In 1900 the population was 187. The census of 1910 gives it 212, or a gain of only 13.3 per cent.

Sardis.

Sardis is a small rural village located on Tenmile creek at the mouth of Katys Lick creek, 6 miles northwest from Clarksburg. It is surrounded by a rich agricultural community. In 1900 the population was reported as 139. The census of 1910 gives it 255.

Jarvisville.

Jarvisville is another small rural village located on the south fork of Tenmile creek, 8 miles southwest of Clarksburg. It is situated at the eastern edge of the Fifth Sand oil belt of Harrison county, and for that reason has been a busy little town. In 1900 it had a population of 163. The census of 1910 gives it 195.

Brown.

Brown is located on the W. Va. Short Line Branch of the Baltimore & Ohio Railroad, on Little Tenmile creek, 18.4 miles by rail northwest from Clarksburg. The same distance by air line is only ten miles. In 1900 the population of the town was reported as 154. The census of 1910 gives it 225.

The following is a list of additional towns and crossroad villages other than those described above in Harrison county, with their population added both for 1900 and 1910:

	Population.	
	1900	1910
Quiet Dell	132	210
Rockford	127	180
Johnstown	129	175
Goodhope	66	95
Dola	61	150
Wyatt	73	125
Romines Mills	121	130
Benson	31	125
Mineral	53	53
Farnum	31	25

Jimtown	54	45
Peora	43	75
Oral	22	16
Lynch (Maken)	24	23

The towns in the above list are merely crossroad villages, generally having a post office, blacksmith shop and store to accommodate the farmers of the surrounding region. The census bureau of Washington, D. C., does not give the population of unincorporated towns; hence population statistics for these smaller places in both counties were largely obtained from Rand-McNally's "Shipper's Guide of West Virginia."

CHAPTER II.

THE PHYSIOGRAPHY OF THE DODDRIDGE-HARRISON AREA.

A description of the physiography of any region cannot fail to interest anyone engaged in a scientific study of nature's works. To the old resident of the Doddridge-Harrison area, the general surface configuration as represented by the hills and valleys, seems never to change, but on the contrary appears to have preserved its present forms throughout all the ages. However, these land forms pass through a life cycle—**youth, maturity** and **old age**—in a very similar manner as does the world of living organisms. When time is considered in a geologic sense these changes are taking place rapidly, though probably not observed by the untrained eye.

The engraving tools that disintegrate the rock material and start it on its march to the sea, its final resting place, are the atmosphere with its evaporation, precipitation, and electrical effects; its variations of temperature, heat and cold; and running water, both surface and underground.

Geologic study has shown that the Appalachian area was reduced to a peneplain in Cretaceous time, and re-elevated to be reduced to a second peneplain during the Tertiary period. Again to be re-elevated at the close of the Tertiary period, and at the present time is being reduced to a third peneplain.

In the Marshall-Wetzel-Tyler report of the State Survey, the writer has there given a full description of the different life periods of the land forms, to which the reader is referred for a discussion of the same.

The rivers and large streams pass through the same cycle of development as the land forms, in a manner similar to the life history of organic forms, passing from the period of **infancy**, or **youth**, through **adolescence, maturity** to **old age** and death. The erosive life of a river or smaller stream is not measured so much from the duration of its existence as by the work of erosion it has accomplished and what yet remains to be completed. The writer gives the following account of the different stages of a stream's life history in the Wirt-Roane-Calhoun Report, pages 30-31:

"In the early stage of the stream's formation the longitudinal slope of its channel as it cuts its way downward, is steep. Erosion is necessarily rapid through the softer rocks, the harder and more resistent layers forming water falls and the stream, now in its period of infancy or youth, is passing to adolescence. It is now cutting its channel deeper and deeper and does very little lateral erosion. As the channel floor of the stream approaches closer to the level of its mouth, the gradient is much reduced and as a consequence the current of the stream much slower, and the hard, projecting ledges are brought to the general slope of the stream. Its load of sediment, formerly carried out by the swifter stream, is deposited in flood-plains. the river now taking up the work of lateral erosion except in case of floods, and over these flood-plains takes a meandering course, cutting in on one bank and depositing on the other. It is now carrying its maximum load of sediment and is performing its greatest work of erosion and is said to be in the maturity of its life.

"The period of old age is said to be reached by the river when it has graded its valley floor nearly to sea level. The current then becomes sluggish and absent, the falling sediment obstructing the channel, and the river is not able to perform the work of erosion any longer, settling down to a period of senility.

"All the periods of a river's life may be represented at the same time. The lower course reaches old age first while the upper course is pushing its way back into the divide in early maturity, while some of its tributaries are in the period of youth. Sometimes on the steeper slope of a divide the swifter and more rapid stream cuts through the divide, taps the head-waters and robs a stream on the opposite side. This is called stream piracy. The remnants of the old stream, still pursuing their old courses, are spoken of as beheaded streams. A case in point is Beaver Dam creek where it formerly crossed Blue Ridge, 6 miles due south of Charlestown, W. Va. [1]This stream was unable to deepen its channel across this hard rock ridge as rapidly as the Shenandoah branch of the Potomac lowered its bed, and as a result the first stream was beheaded by the Shenandoah river. This is only one of the numerous instances of this kind.

"It sometimes happens that a stream in mature age is revivified with all the appearances of youth. For instance, take a peneplain that has been elevated to an upland, having its mature, meandering rivers. It naturally follows that the work of erosion is taken up first along these old channels. These rivers take on the activity of renewed youth and cut their inherited gorges with their winding courses deeper. Thus we have a youthful stream with many features of inherited maturity.

"Sometimes the course of a river and topographic history may be influenced by forces so unusual as to be termed a 'geologic accident'.

---

1. Professional Paper No. 60, p. 51, U. S. Geol. Survey; 1908.

Such was the case during the Quaternary period of the history of the North American continent, when the northern seas were covered with an ice sheet of great extent and thickness. This great wall of ice moved southward, forming dams across the courses of rivers, resulting in great ponds and lakes, causing them to overflow at some low point in their enclosing valley walls. Here further erosion would take place, and form a new channel which might be continued when the ice-barrier melted away."

The southern terminus of this great northern glacier referred to above was 70 to 80 miles northwest from the Doddridge-Harrison area, but the indirect effects of its flood and water extended over a considerable portion of the two counties; viz., along both banks of West Fork river and its tributaries in Harrison county, and along the waters of Middle Island creek in Doddridge.

If an examination is made of the drainage system of the area under discussion, it is found that in Harrison the West Fork river and its several tributaries have a distinct northward trend, showing beyond doubt that they flowed into the Monongahela when the latter was a tributary to the ancient and pre-glacial Pittsburgh river, the latter running northward from near the present site of Beaver Falls, Pa., into the St. Lawrence drainage basin. It is also found that in Doddridge, Middle Island creek and its tributaries have a distinct northwest trend, and that it is quite probable that this stream's channel constituted a part of the drainage system of the pre-glacial Marietta river. None of the streams of the Doddridge-Harrison area has as yet reached base level, but, with the exception of West Fork river, all have a rapid rate of fall, with meandering courses, tending to show that they possess this mature character by inheritance.

The following table shows in a graphic manner not only the rate of fall per mile of the principal streams of the Doddridge-Harrison area, but their departure from a straight line course, and the ratio of the total distance between the points on the same, measured by the meanders of the streams, to the air line distance between the same points:

STREAMS	Total Fall Feet	Total Distance Miles	Rate of fall per Mile, Feet	Air Line Distance Miles	Ratio T. D. to A. L. D.
West Fork river, from Lewis-Harrison Co. line to Tygarts Valley river	112	55.8	2.0	27.6	2.0
West Fork river, from Lewis-Harrison Co. line to Weston	31	10.0	3.1	6.6	1.5
Bingamon creek, mouth to Peora	69	6.4	10.7	4.0	1.6
Bingamon creek, Peora-Margaret	74	6.8	10.9	5.8	1.1
Tenmile creek, mouth to Marshville	71	12.2	5.8	7.6	1.6
Tenmile creek, Marshville to Jarvisville	78	8.4	9.3	6.2	1.3
Little Tenmile, mouth to Wallace	78	7.8	10.0	6.8	1.1
Kincheloe creek, mouth to Benson	62	5.8	10.6	5.4	1.1
Booths creek, mouth to Boothsville	86	7.8	11.0	4.6	1.7
Booths creek, Boothsville to Meadland	350	6.8	51.4	5.3	1.3
Shinns run, mouth to Saltwell	95	3.2	29.7	2.9	1.1
Simpson creek, mouth to Douglas run	81	12.2	6.2	8.0	1.5
Simpson creek, Douglas run to Simpson	100	7.6	13.1	6.9	1.1
Elk creek, mouth to mouth of Gnatty	76	13.2	5.8	8.5	1.5
Elk creek, mouth of Gnatty to Elk City	82	10.0	8.2	8.8	1.1
Browns creek, mouth to 2 miles southeast of Byron	140	3.6	38.8	3.6	1.0
Lost creek, mouth to Rockford	72	6.6	10.9	5.0	1.3
Hackers creek, mouth to Berlin	55	12.2	4.5	8.0	1.5
Hackers creek, Berlin to Ruraldale	85	7.4	11.4	6.7	1.1
McElroy creek, mouth to mouth of Flint	44	10.2	4.3	5.8	1.8
McElroy creek, mouth of Flint to Centerpoint	48	7.6	6.3	5.3	1.4
McElroy creek, Centerpoint to Cascara	142	6.8	20.9	5.2	1.3
Flint run, mouth to Flint P. O.	105	6.9	15.2	5.7	1.2
Middle Island, mouth of Arnolds creek to mouth of Bluestone	46	10.5	4.3	5.0	2.1
Middle Island, mouth of Bluestone to Avon	97	14.8	6.5	9.1	1.6
Middle Island, Avon to Big Isaac	115	6.6	17.4	6.0	1.1
Arnolds creek, mouth to Claylick run	78	6.8	11.4	4.6	1.5
Hughes river, Oxford to Kelly	100	6.0	16.6	5.6	1.1
Hughes river, Summers to Grove	90	4.2	21.4	3.6	1.1
Cove creek, mouth to Leopold	100	8.8	11.4	7.2	1.2

In the last column of the above table is given the ratio of the total distance (T. D.) measured by the meanders of the stream to the air line distance (A. L. D.). In each instance it is very evident that the nearer this ratio approaches unity, the greater the rate of fall.

Prior to the glacial period, the Monongahela river and its larger tributaries probably cut their channels to near the base level of the old Pittsburgh river, and then started to cut their present meandering channels. Middle Island creek and its larger branches probably did likewise with reference to the Old Marietta river. Later the greatly increased volume of water in the Ohio, now flowing southwestward, cut its channel deeper much more rapidly than its tributaries, and thus revivified the latter with new life and energy.

The heavy deposit of silt in the low gap near the west

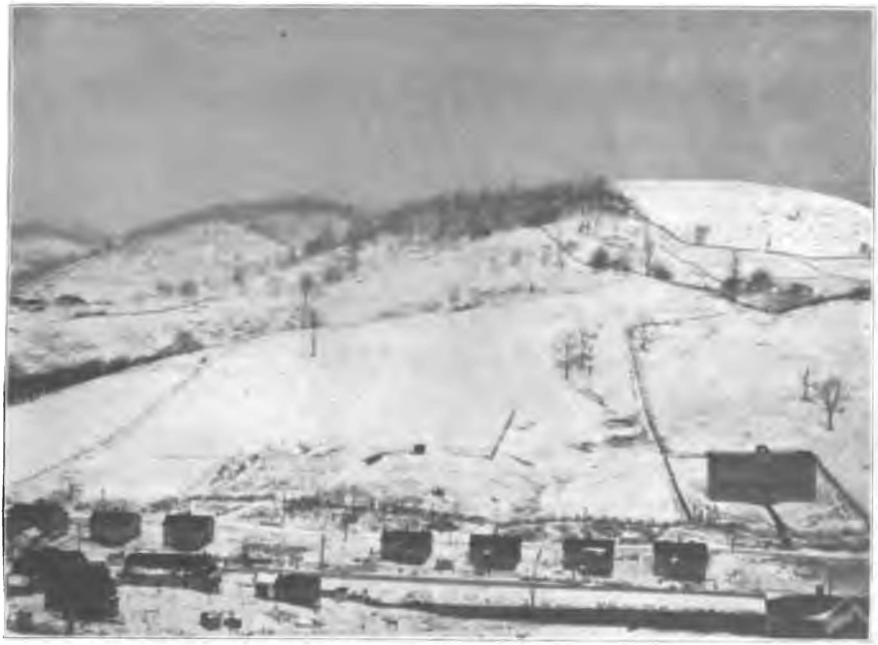


PLATE III (a).—Topography of the Monongahela series at Reynoldsville, Harrison county.

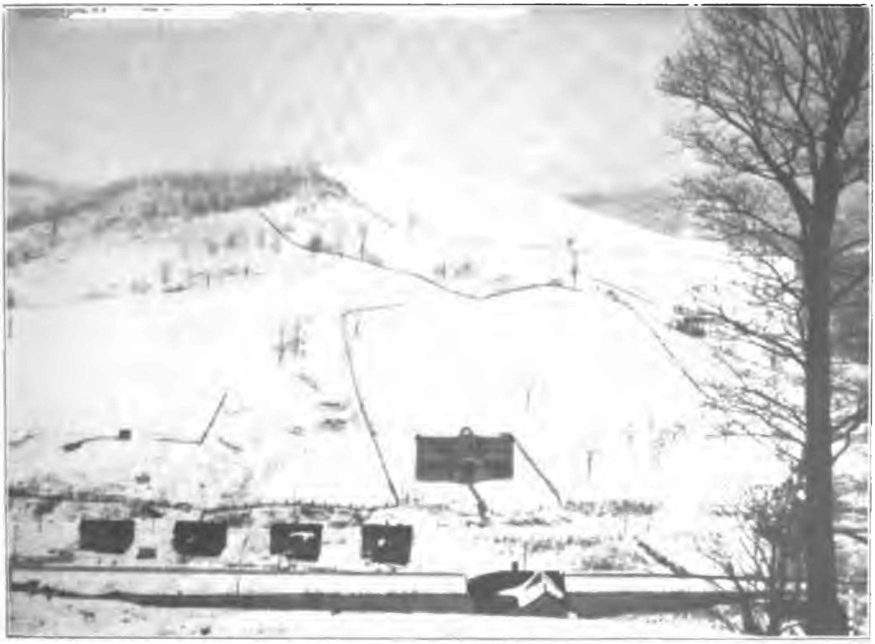


PLATE III (b).—Same slightly farther east.

edge of Salem, Harrison county, is evidence that this depression in the dividing ridge between the waters of the old Pittsburgh and Marietta rivers was occupied by quite a large stream of water during the glacial period, connecting both drainage basins.

DESCRIPTION OF THE DRAINAGE BASINS.

West Fork River.

The West Fork river is the largest stream in the Doddridge-Harrison area. It almost bisects Harrison county in a northeast-southwest direction, and together with the Tygart Valley river forms the Monangahela, one mile and a half southwest from Fairmont. West Fork has its head in the southern portion of Upshur county, 47.6 miles by air line measurement from its mouth. The distance measured by the meanders between the same points is 91.5 miles. The entire area of its drainage basin is 842.8 square miles. The whole of Harrison county lies within this basin. By far the larger portion of this basin has been stripped of its original forests and is under cultivation. For that reason it is subject to sudden floods and periods of very low water to a much greater extent than the Tygart Valley fork of the Monongahela, this river having its headwaters mostly in a forest covered region. Along both banks of West Fork in Harrison county there occur a series of alluvial terraces which will be described on a subsequent page of this report.

In order to determine the surface water supply of the Ohio river basin, the United States Geological Survey established several gauging stations on the many large tributaries of the latter in West Virginia. One of these stations is located on West Fork river at Enterprise, Harrison county, 12 miles by the meanders of the latter above the junction of West Fork and Tygart Valley rivers. The following interesting data obtained at the Enterprise gauging station, is taken from Water Supply paper No. 263 of the U. S. Geological Survey, pages 49 and 50:

"This station, which is located at the highway bridge at Enterprise, W. Va., was established June 2, 1907, to obtain data for use in

studying water power, water supply, pollution, flood control, and storage problems.

"Bingamon Creek is tributary from the west about 1 mile below the station.

"Winter conditions are mild and ice does not form very thick, if at all.

"A small dam is located at Worthington, about 3 miles below the station, but backwater does not reach to the section, for, from December 5 to 12, 1908, when the gates of the dam were opened to let water out of the pond, no effect was produced at the gage. The gage reader states that during the summer of 1908 the only water running in the river was the pumpage from the numerous coal mines along the stream.

"The datum of the chain gage, attached to the bridge, has remained unchanged; the records are reliable and accurate.

"Sufficient data have not yet been collected to enable estimates of flow to be made."

Discharge measurements of West Fork River at Enterprise, W. Va., in 1909.

Date	Hydrographer	Width	Area of Section	Gage Height	Discharge
		Feet	Sq. Feet	Feet	Sec. Ft.
May 18	A. H. Horton................	153	292	1.68	128
December 6	G. L. Parker................	151	240	1.40	60

Daily gage height, in feet, of West Fork River at Enterprise, W. Va., in 1909.

(C. M. Tetrick, observer.)

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1................	1.3	2.9	4.8	3.8	8.9	1.9	2.6	1.6	1.3	1.2	1.6	1.5
2................	1.1	2.8	4.4	3.4	7.0	1.8	2.3	1.5	1.2	1.2	1.5	1.5
3................	1.6	2.6	3.5	3.0	5.2	1.8	1.9	1.4	1.2	1.1	1.5	1.5
4................	1.8	4.8	3.6	3.3	4.5	1.8	1.3	1.3	1.2	1.0	1.5	1.5
5................	1.8	4.4	6.2	3.8	3.8	2.4	1.5	1.2	1.2	1.0	1.6	1.5
6................	1.9	4.0	4.2	3.4	3.2	2.3	1.5	1.4	1.1	.9	1.5	1.4
7................	1.8	3.9	4.0	3.0	2.8	2.5	1.4	1.3	1.1	.9	1.5	1.5
8................	1.7	3.8	3.8	2.7	2.5	2.4	1.3	1.2	1.1	1.0	1.4	1.6
9................	1.7	4.3	3.7	2.5	2.3	9.1	1.2	1.1	1.1	.9	1.4	1.7
10................	1.6	8.3	3.5	2.3	2.2	4.8	1.1	1.0	1.9	.9	1.5	2.0
11................	1.5	6.8	4.4	2.2	2.1	5.3	1.1	.9	4.3	.9	4.3	1.8
12................	2.3	5.2	3.8	2.1	2.0	4.8	1.0	.8	3.2	1.2	3.3	6.4
13................	1.8	4.8	3.6	2.1	1.9	4.5	1.5	.8	2.2	1.5	2.5	4.6
14................	1.7	4.3	3.4	6.7	1.9	3.3	1.7	.8	1.8	1.4	2.2	3.5
15................	8.5	3.9	2.9	5.6	1.7	4.3	1.8	1.2	1.6	1.4	2.0	3.1
16................	6.4	10.9	2.6	4.4	1.7	3.5	2.0	2.0	1.5	1.4	1.9	2.9
17................	4.8	8.3	4.3	3.3	1.7	2.8	1.9	2.5	1.4	1.4	1.8	2.8
18................	6.4	3.8	4.0	3.0	1.6	7.1	1.7	2.0	1.3	1.5	1.7	2.7
19................	4.1	4.3	3.7	2.8	1.5	6.6	1.8	1.9	1.2	1.4	1.6	2.6
20................	3.3	4.8	3.2	3.3	1.5	5.5	1.7	1.7	1.2	1.4	1.6	2.5
21................	2.8	3.8	2.9	9.4	1.9	3.0	1.5	3.4	1.2	1.4	1.5	....
22................	2.7	5.0	4.4	10.3	2.6	2.6	1.4	2.7	1.1	1.4	1.5	....
23................	2.4	4.3	3.8	9.3	2.2	2.7	1.3	2.3	1.1	1.6	1.5	....
24................	4.3	10.0	3.5	7.1	2.0	2.6	1.2	1.8	1.1	7.2	1.5	....
25................	3.9	7.9	3.2	5.4	1.8	2.6	1.5	1.6	1.5	6.4	1.6	....
26................	3.4	5.9	3.0	4.6	1.7	2.5	1.7	1.4	1.2	3.8	1.8	....
27................	3.0	4.8	2.9	4.0	2.0	4.2	1.6	1.3	1.1	2.8	1.7	2.3
28................	2.8	5.3	2.8	3.5	2.5	9.3	1.5	1.2	1.4	2.3	1.6	....
29................	2.8	....	4.3	3.0	2.3	4.4	1.4	1.1	1.2	2.2	1.6	....
30................	3.3	....	3.9	2.8	2.2	3.3	1.6	1.3	1.3	1.8	1.6	....
31................	3.0	....	3.6	....	2.1	....	1.7	1.3	....	1.8	....	....

Note.—Ice conditions December 18 to 31. Thickness of ice December 27, 0.3 foot."

An examination of the above tables readily shows that the low water period for the West Fork river for the year 1909 occurred during the months of July, August, September, October and November. However, the year 1911 will show this stream having high water stages during the whole of the months of September and October. Hence, as mentioned in the Water Supply Paper referred to above, the gages have not extended over a sufficient number of years to be reliable.

Haymond[2] gives the following interesting account of an early attempt to obtain slackwater on West Fork river:

> "The Legislature on January 19, 1817, passed an act incorporating a company for the improvement of the navigation of the West Fork and Monongahela rivers to be called the Monongahela Navigation Company.
>
> "The object of the Company was to make a channel navigable for flat boats, rafts and lumber at all seasons from the mouth of Stone Coal Creek on the West Fork River down that stream and the Monongahela to the Pennsylvania State line, and were authorized to construct locks, slopes and dams for that purpose.
>
> "Authority was also given the Company to cut a canal and divert the waters of the Buckhannon river to the waters of the West Fork river, for the purpose of procuring an additional supply of water.
>
> "The following persons were authorized to open books in Clarksburg to receive subscriptions for stock to aid the enterprise. The shares were for $100.00 each and the amount limited to $150,000.
>
> "John G. Jackson, Benjamin Wilson, Jr., James Pindall, George I. Davisson, William Williams and David Hewes, John Stealey, Ralph Berkshire, Felix Scott, Thomas Wilson, John Rogers and George S. Darling were authorized to receive subscriptions.
>
> "Additional acts were subsequently passed enlarging the powers of the Company and a survey was made from Weston down to the Pennsylvania State line, and the distance was found to be 107 miles and the fall 223 feet.
>
> "The work was commenced on the West Fork in Harrison County and several dams were constructed.
>
> "The sum of a fraction less than $21,000 was expended in this work, one fifth of which had been contributed by the State of Virginia, which was a large sum for that day.
>
> "Shortly after these dams were constructed and others about to be commenced there came one of Noah's floods, which did so much damage to the property that the enterprise was abandoned.
>
> "In 1829 proceedings were instituted in the Circuit Court by the Board of Public Works to declare the rights and franchises of the Company forfeited and vested in the said Board.
>
> "The dams constructed by the Company were declared common nuisances and the sheriff was ordered to abate them. These dams are described as located one at the mouth of Jack Run, one at or near Lambert's Run, one at the Falls above the mouth of Ten Mile Creek, one near Benjamin Reader's and one at the White rocks."

---

[2] History of Harrison County, pages 427 and 428; 1910.

In Harrison county there occur several well defined old abandoned channels of West Fork river. Taking these up in succession from south to north, we find the first of these now occupied mostly by the small stream, nearly two miles in length, that empties into the river from the east side, one mile and a half below the mouth of Hackers creek. Passing on down the river about three miles, we find a well marked old channel, the upper portion of which is at present occupied by Duck creek for three-fourths mile in its lower course. The other leg of the channel evidently passed to the east side of the round knob, located one-half mile northeast from the mouth of Duck creek. It also seems quite probable that the river once flowed through the low gap at the southeast edge of the round knob, located one-half mile due south of the town of West Milford. Passing on down West Fork to a point about two miles below West Milford, we find an old channel of the river just east of the public highway extending northward from Highland ford to Allen ford. On below this at a point about one mile northwest from Farnum, we find an old abandoned channel, barely two miles long, which is now closely followed by the W. Va. Short Line Branch of the Baltimore & Ohio Railroad. Then, too, at Meadowbrook, we find an old abandoned channel of the river extending almost due northward from the latter point and having a length of slightly over a mile. It is also closely followed by the same railroad.

In Harrison county, the principal western tributaries of the West Fork river, from north to south, are Bingamon creek, Robinson run, Tenmile creek, Lambert, Crooked, Limestone and Davisson runs, and Coburn, Sycamore, Buffalo, Isaacs, Lick and Kincheloe creeks. Its eastern branches, from north to south, are Laurel, Mudlick and Shinns runs, and Simpson, Elk, Browns, Lost, Duck and Hackers creeks. A brief description will now be given of the most important of these tributaries.

Bingamon Creek.—Bingamon creek empties into West Fork river one mile north of Enterprise, at the point where the Marion-Harrison county line crosses the latter stream.

It has its source at the common corner to Wetzel, Marion and Harrison counties, and has a narrow "V" shaped valley with high steep walls. The area of its drainage basin is 46 square miles. The total distance from its mouth to its head, measured by the meanders of the stream, is 16.2 miles. The air line distance between the same points is 11.7 miles. From Margaret to Peora the stream falls 74 feet in a distance of 6.8 miles, or at the rate of 10.9 feet to the mile. From Peora to the mouth of Bingamon, the stream falls 69 feet in a distance of 6.4 miles, or at the rate of 10.7 feet to the mile. The lower part of its course is quite crooked. It no doubt possesses this mature character by inheritance from glacial times.

Tenmile Creek.—Tenmile creek empties into the West Fork river one mile and a half below Gypsy. It has its source in the extreme western point of Harrison county, one mile west of Salem, and flows in a northeasterly direction with a meandering channel. From its head to its mouth, measured by the windings of the stream, the distance is 26.4 miles. The air line distance between the same points is only 15.6 miles. From Jarvisville to Marshville the stream falls 78 feet in 8.4 miles, or at the rate of 9.3 feet to the mile. From Marshville to its mouth, the fall is 71 feet in a distance of 12.2 miles, or at the rate of 5.8 feet to the mile. The entire area of its drainage basin is 126 square miles. Its largest tributary is Little Tenmile creek, whose drainage basin has an area of 28.4 square miles.

Kincheloe Creek.—Kincheloe creek has its source in the extreme southwest corner of Harrison county, and empties into West Fork river at the point where the latter stream crosses the Harrison-Lewis county line. The area of its drainage basin is 21.3 square miles. Measured by the meanders of the stream, it is 8.6 miles from its head to the mouth. The air line distance between the same points is 7.8 miles. From Benson P. O. to the mouth of Kincheloe, the total fall is 62 feet in 5.8 miles, or at the rate of 10.6 feet to the mile. It has a narrow "V" shaped valley, with high fairly steep walls. Like all the tributaries of West Fork river, the stream is passing through the period of infancy or youth as is well indicated by the rapid rate of fall and the work of erosion it has yet to perform.

Booths Creek.—Booths creek drains the northeast corner of Harrison county. It has its source near Meadland P. O. in western Taylor county, and flows northwestward via Boothsville, emptying into West Fork river at Monongah, 5 miles above the mouth of the latter stream. The area of its drainage basin is 45 square miles, only a small portion of which is included within the boundaries of Harrison county. From its head to the mouth, measured by the windings of the stream, the distance is 16.4 miles. The air line distance between the same points is 11.6 miles. From Meadland to Boothsville, the stream has a total fall of 350 feet in a distance of 6.8 miles, or at the rate of 51.4 feet to the mile. From Boothsville to its mouth, Booths creek falls 86 feet in a distance of 7.8 miles, or at the rate of 11 feet to the mile. These figures illustrate in a graphic manner that the different periods of a stream's life may be represented at the same time. The rapid rate of fall in its upper course shows this portion of the stream to be in the period of infancy or youth, while the lower course is rapidly approaching the period of adolescence.

Simpson Creek.—Simpson creek empties into West Fork river at Meadowbrook. It has its source 5 miles southwest from Grafton, Taylor county. The area of its drainage basin is 84.6 square miles, about one-half of which is situated in Harrison county, and the residue in Taylor and Barbour. From its mouth to its head, the distance is 21.6 miles. The air line distance between the same points is only 15 miles. From the town of Simpson to the mouth of Douglas run, three-fourths of a mile west of the Taylor-Harrison county line, Simpson creek falls 100 feet in 7.6 miles, or at the rate of 13.1 feet to the mile. From the mouth of Douglas run to the mouth of Simpson creek, the latter stream falls 81 feet in 12.2 miles, or at the rate of 6.6 feet to the mile. In this portion of its course it has a wide meandering channel. This mature character, however, is evidently one of inheritance, since the rate of fall, 6.6 feet to the mile, shows that it has not yet reached base-level with West Fork river. The creek flows in a northwest direction entirely across the great Chestnut Ridge anticlinal.

Elk Creek.—Elk creek empties into West Fork river at Clarksburg. It was so designated by the pioneers from the animal of that name which formerly abounded on the stream. The present head of Elk creek is represented by the head of Indian fork, 3 miles northeast from Century, Barbour county. A study of the topography of this region inclines the writer to the belief that the latter branch formerly flowed directly into Tygart river a short distance above Philippi, but later was robbed by the ever advancing headwaters of Elk into the high plateau of this locality. The area of the drainage basin of Elk creek is 121.7 square miles. From its head to its mouth, measured by the windings of the stream, the distance is 28.6 miles. The air line distance between the same points is only 16.8 miles. From Elk City to the mouth of Gnatty creek, Elk falls 82 feet in 10 miles, or at the rate of 8.2 feet to the mile. From the mouth of Gnatty to Clarksburg, it falls only 76 feet in 13.2 miles, or at the rate of 5.8 feet to the mile. In this portion of its course Elk has a wide meandering channel, but the rapid rate of fall is evidence that this mature character is inherited from some past period of the stream's life history. At two different points along the course of Elk there occur well defined old abandoned channels. The first of these is found one-half mile southwest from the town of Quiet Dell, Harrison county, where the stream evidently flowed through the low gap between the two round knobs on the east bank of the present channel of Elk. The other is located one mile southeast from Clarksburg, ¼ to ½ mile west from the present channel of Elk and between the mouths of Fowlkus and Nutter runs.

Lost Creek.—Lost creek empties into West Fork river one mile and a half below the town of West Milford. Its source is at the common corner to Harrison, Upshur and Lewis counties. From the latter point to its mouth, the distance is 9.6 miles. The air line distance between the same points is 7.4 miles. From the town of Rockford to its mouth, Lost creek falls 72 feet in a distance of 6.6 miles, or at the rate of 10.9 feet to the mile. The area of its drainage basin is 20 square miles.

Hackers Creek.—Hackers creek rises about one mile southwest from Pecks Run P. O., Upshur county, and flows northwestward via Ruraldale, Berlin and Jane Lew, emptying into West Fork River one mile and a half below the intersection of the latter stream with the Harrison-Lewis county line. The area of its drainage basin is 54.4 square miles. From its head to its mouth, measured by the windings of the stream, the distance is 21.4 miles. The air line distance between the same points is only 13.8 miles. From Ruraldale to Berlin, the stream falls 85 feet in 7.4 miles, or at the rate of 11.4 feet to the mile. From the latter point to its mouth, Hackers creek falls only 55 feet in 12.2 miles, or at the rate of 4.5 feet to the mile. In this latter portion of its course the creek has approached nearer to base-level with West Fork river than any other tributary of the latter stream, or in other words, is fast approaching the period of adolescence. Its very crooked channel, bordered by wide bottoms, is mute testimony to the fact.

Middle Island Creek.—Middle Island creek has its source in the extreme eastern point of Doddridge county, and flows northwestward via Big Isaac, Avon, West Union, Deep Valley and Middlebourne, emptying into the Ohio river one mile above St. Marys. A full description of this stream in its lower course is given by the writer in the report of Marshall, Wetzel and Tyler Counties, pages 46 and 47. The entire area of its drainage basin is about 560 square miles, nearly one-half of which lies within the boundaries of Doddridge county. From its mouth to its head, measured by the windings of the stream, the distance is 94.7 miles. The air line distance between the same points is only 38.3 miles. From Big Isaac to Avon, the creek falls 115 feet in 6.6 miles, or at the rate of 17.4 feet to the mile. From the latter point to the mouth of Bluestone, the fall is 97 feet in 14.8 miles, or at the rate of 6.5 feet to the mile. From the latter point to the mouth of Arnolds creek at the Doddridge-Tyler county line, the fall is 46 feet in 10.5 miles, or at the rate of 4.3 feet to the mile.

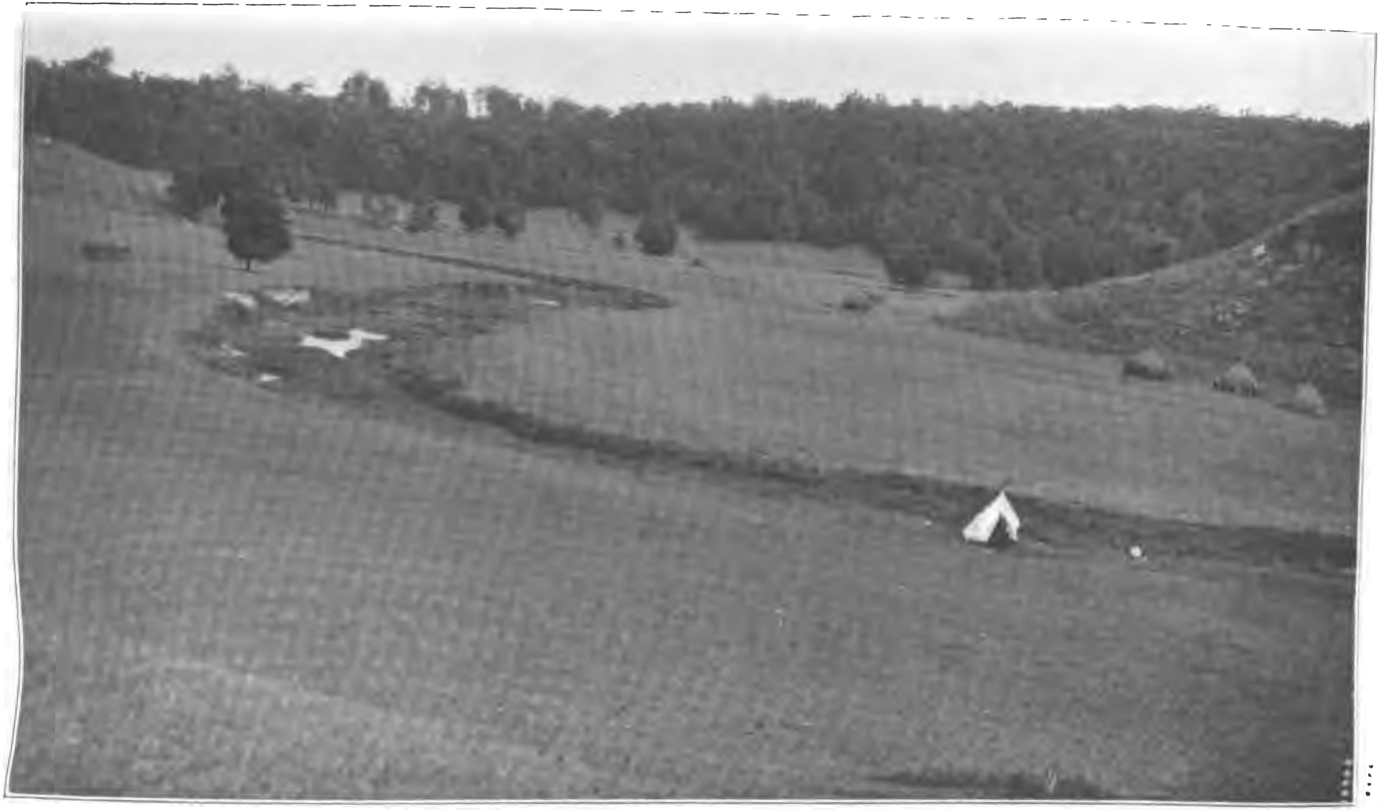


PLATE IV.—Wide valley eroded by Hackers creek, one mile above its mouth. (See description of stream). Here the Valley Walls are in the Conemaugh series.

The creek has a very low rate of fall from West Union to the Ohio river, and is fast approaching base-level with the latter stream.

Its important tributaries in Doddridge county are McElroy creek, Flint run, and Arnolds creek. A short description will now be given of each.

McElroy Creek.—McElroy creek drains the northern portion of Doddridge county. It has its source 2 miles northwest from Salem, and flows in a northwest direction via Cascara, Sedalia, Centerpoint, and Ashley, crossing the Doddridge-Harrison county line at Eagle Mills and emptying into Middle Island creek one-half mile east from Centerville, Tyler county. The area of its drainage basin is 106.4 square miles, by far the larger portion of which lies in Doddridge county. The distance from the mouth to the head of McElroy is 26.4 miles. The air line distance between the same points is only 15.5 miles. From Cascara to Centerpoint, the creek falls 142 feet in 6.8 miles, or at the rate of 20.9 feet to the mile. From the latter point to the mouth of Flint run, the fall is 48 feet in 7.6 miles, or at the rate of 6.3 feet to the mile. From the mouth of Flint to Middle Island creek, McElroy falls 44 feet in 10.2 miles, or at the rate of 4.3 feet to the mile. In the last ten miles of its course it is rapidly approaching base-level with Middle Island creek, but has not yet reached the period of adolescence. Its channel is quite crooked, especially below Centerpoint, having high steep valley walls; hence it is quite evident that it possesses this mature character by inheritance.

Arnold Creek.—Arnold creek drains the western portion of West Union district and the eastern portion of Central district, Doddridge county. The stream has its source 2½ miles northwest from Kelly P. O. It flows northward and passes just east from Central Station, emptying into Middle Island creek at the Doddridge-Tyler county line. Almost its entire drainage basin lies in Doddridge county, the area of which is 34.9 square miles. From its mouth to its head, measured by the windings of the stream, the distance is 12.4 miles. The air line distance between the same points is 9.2 miles. From the mouth of Claylick run to Middle Island creek, Arnold falls 78 feet in a distance of 6.8 miles, or at the rate of 11.4 feet to the mile. It has a narrow "V" shaped valley with high steep walls. The rapid rate of fall as well as the work of erosion yet to be accomplished shows the stream to be still in the period of youth.

South Fork, Hughes River.—The southwestern portion of Doddridge county is drained by the waters of the South Fork of Hughes river. The former has its source one mile and a half southeast from Kelly P. O. It flows northwest via Kelly and Nay, crossing the Doddridge-Ritchie county line at Oxford. The area of its drainage basin in Doddridge, including that portion of the basin of its tributary, Middle Fork, is 31.2 square miles. From Kelly to Oxford, South Fork falls 100 feet in 6 miles, or at the rate of 16.7 feet to the mile. The junction of South Fork and North Fork at Cisko on Ritchie-Wirt county line forms Hughes river.

TOPOGRAPHY OF THE LAND AREA.

Like other counties of western West Virginia, the Doddridge-Harrison area is a highly dissected plateau, ranging in elevation from 1,000 to 1,800 feet above sea level. The agencies of erosion have reduced the plateau practically all to slope. The streams generally flow in narrow, deeply indented "V" shaped valleys. The numerous ridges and knobs, capped with harder layers of rock strata, ranging from 1,000 to 1,800 feet above tide, bear testimony of the existence of this former plateau.

The West Fork river has cut a deep gorge from ½ to 1 mile in width and 250 to 500 feet in depth entirely across central Harrison county in a north and south direction, through almost horizontal layers of rock. Middle Island creek has done likewise in a northwest-southeast direction entirely across Doddridge county. The valley walls in many places are quite steep and rough, caused by the outcrop of great sandstone ledges, but over a large portion of Harrison county the outcropping limestones of the Monongahela series have weathered into a fairly uniform gentle slope. The general surface of the uplands is rolling except when trenched by small ravines.

The flood plains of West Fork river are represented by narrow strips of fertile bottom land along both shores that widen out first on one side, then on the other.

River Terraces.—Several pronounced terraces occur along both valley walls of West Fork river in Harrison county. The most persistent and readily recognized terrace occurs at an elevation ranging from 1,040 to 1,100 feet above tide. The towns of Goodhope, West Milford and Clarksburg are built largely on this erosion bench. The latter terrace was most probably formed when the great glacial dam came down from the north, changing the course of the ancient Pittsburgh river near Beaver Falls, Pa., from its old route across the State of Ohio to Lake Erie, to a southwest direction and forming the present Ohio river. At this time a great interior lake was formed within the valley walls of West Fork and other tributaries of the Monongahela river by back-water from the glacial dam at Beaver Falls, Pa., the summit of which probably reached an elevation of 1,100 to 1,120 feet above tide. In fact, the deposit of silt and clay in the region of the low gap west of Salem, Harrison county, makes it appear quite probable that this great lake overflowed through this depression in the dividing ridge into the present drainage system of Middle Island creek, the latter at that time belonging to the old Marietta river system. This old terrace is well defined along both banks of West Fork river south from Clarksburg to the Harrison-Lewis county line. North of Clarksburg the terrace is very pronounced on the west side of the river to Lumberport, and advantage was taken of the same in building the W. Va. Short Line Branch of the Baltimore & Ohio Railroad. It is also well defined along both banks of the river north from the mouth of Tenmile creek to the Harrison-Marion county line.

PART II.

The Geology of the Doddridge-Harrison Area.

CHAPTER III.

STRUCTURE.

Introduction.

Geologic structure treats of the pitch or lay of the strata of any region under discussion. The original position of rock beds, whether formed by sedimentation or lava flows, is normally horizontal. The original attitude of these rocks, however, is later much changed by tangential pressure brought about by the contraction of the earth's interior, and the rocks composing the crust of the latter are bent and warped by this pressure into a number of approximately parallel wrinkles or folds. In the Doddridge-Harrison county area these folds all have a distinct northeast-southwest trend. In the discussion of these structural forms, the upward bending arch is called an **anticline** and the downward bending trough a **syncline.** The **axis** of a fold is the line joining the highest points of an anticline and the lowest points of a syncline. The strata dip from the axis of the former and to the axis of the latter. The **strike** is the direction of the horizontal edges of dipping strata. The **nose** of an anticline is the term applied to the structural form made by the sudden rise or fall in elevation of the axis of the fold.

Method of Representing Structure.

In geologic mapping there are two methods in general use in representing structure. One of these is by means of cross sections at right angles to the line of strike. These show how the strata would appear if deep ditches were dug perpendicular to the line of strike entirely across the two counties. This method is quite satisfactory where faulting takes place, or the folds overturn as they frequently do. In the area under discussion several of the folds are so slight that the method would be very unsatisfactory, since the folds would hardly be noticeable on a map of the scale accompanying this report and on which the economic geology is exhibited; again, the method does not give the desired knowledge of the shape of the arches or basins in the area, a feature that is very essential to the future development of its mineral resources with special emphasis on coal, petroleum and natural gas.

A second method that fills the latter conditions consists in the representation by contour lines that show the elevation above sea level of some particular rock bed. This stratum is generally one that is known from its wide and persistent outcrop, its exploitation by mines, and sometimes by its frequent use as a "key rock" by drillers for oil and gas in the region to be mapped.

In the Doddridge-Harrison area the writer has selected the Pittsburgh coal bed as the stratum that meets the above conditions. It outcrops over a large portion of Harrison county and has there been mined quite extensively for commercial purposes as well as for domestic fuel. It is also a widely recognized "key rock" by the oil well drillers in eastern Doddridge and western Harrison counties.

The altitude of the top of the Pittsburgh coal bed over a large portion of Harrison county was obtained by levels on its outcrop, but its horizon lies entirely below drainage in Doddridge and in western Harrison. Here its elevation was determined in a large measure from levels on oil and gas wells that had penetrated the bed. The levels are based on the top instead of the base of the Pittsburgh coal for the reason that a very large number of the logs obtained from wells in this region record only the depth to the top of the bed. In central and western Doddridge this coal bed appears to be almost entirely absent from the measures, as revealed by the logs of numerous oil and gas wells in this region. There the elevation of its horizon was determined largely by its interval below the base of the Washington coal bed and above the top of the Big Injun oil sand. The Pittsburgh coal-Big Injun sand interval varies from 1,300 feet in northwestern Doddridge to 1,600 feet in southeastern Harrison. The same interval at intermediate points of the area can readily be obtained from the table of summarized well records, given for each county on subsequent pages of this report. These tables show that the interval gradually thickens southeastward.

The Washington-Pittsburgh coal interval varies from 520 feet in northwestern Doddridge to 600 feet in the southwestern portion of Harrison. The following table reveals the gradual increase of this interval to the southeastward. The figures in parentheses refer to the serial numbers of the oil and gas wells as published on the economic geology map accompanying this report:

Washington Coal-Pittsburgh Coal Interval.

Town or Post Office.	Feet.
(Doddridge County.)	
Alpha	520
Ashley (73), 1 mile southeast	523
Ashley (70), 2 miles southeast	508
Big Battle (31), ¾ mile west	545
Big Battle (111), 1 mile southwest	519
Big Isaac (303), 1.7 mile northwest	573
Big Isaac (311), 2 miles southwest	612
Centerpoint (68)	530
Coldwater (275), 1 mile northwest	566
Coldwater (277), 1 mile east	563
Coldwater (278), 1.5 mile south	585
Duckworth (201), 2 miles southeast	535
Eagle Mills (79), 1¼ mile east	500
Eagle Mills (81)	495
Flint (113), 0.9 mile southwest	529
Harlin (118), ¼ mile southwest	540
Heldreth (9), 1.5 mile south	530
Canton (93)	507
Knight (106)	510
Long Run Station (123), ¾ mile north	533
Long Run Station (124), 0.2 mile north	520
Long Run Station (119), 2 miles north	520
Miletus (296), ½ mile south	577
Nay (210), ½ mile northwest	525
Oxford (210), 1 mile northeast	525
Sedalia (16), 2 miles north	530
Sedalia (25)	558
Smithton (159), ¼ mile east	540
St. Clara (248), 1.5 mile southwest	565
St. Clara (243), 1 mile north	595
Summers (217), 1¼ mile northwest	550
Summers (218), 2 miles northeast	550
West Union (163), 0.4 mile southeast	540
West Union (150), 2 miles north	520
West Union (167), 2 miles southwest	500
(Harrison County.)	
Benson, 1 mile east of	605
Bristol (459), ½ mile south	566
Brown (374), 0.7 mile northwest	595
Brown (379), 1.7 mile north	560
Brown (381), 2 miles northeast	540
Deweytown (475), 1 mile northwest	540
Deweytown (476), 1.5 mile west	540
Deweytown (515), 2 miles southwest	550
Grangeville	545
Joetown	545
Marshville (443), 1 mile southeast	595
Rinehart (348), 0.3 mile east	520
Salem (421), east edge of	550
Wolf Summit (448), 1.3 mile north	595
Wyatt, 1 mile northeast	560

The above table shows that the Washington-Pittsburgh coal interval is quite a variable quantity. In making up the structure map of the area under discussion, the writer assumed an average interval of 520 feet in the northwestern portion of Doddridge county, making the lay of the Pittsburgh coal bed conform to that of the Washington which crops in the hills in this portion of the latter area. It will be noted that the structure contours of the Pittsburgh coal bed along the Tyler-Doddridge county line do not quite check up with the same as outlined on the structure map, prepared by the writer for the counties of Marshall, Wetzel and Tyler, and published by the State Survey in 1909, the latter being apparently 30 to 50 feet higher in elevation than indicated by the former along this boundary line. It is quite probable that the faint streak of coal encountered in several wells in the eastern part of Tyler county in the vicinity of Shiloh and Little Pittsburgh, and identified by the drillers as the Pittsburgh bed, may represent the Redstone seam. These slight discrepancies illustrate the problems that confront the geologist in making structure contour maps on a single stratum over any large area where intervals have to be relied upon at many times to locate its horizon.

In a large portion of southeastern Harrison county the Pittsburgh coal bed passes into the air over the tops of the highest hills. There, its elevation was determined largely by the assumption of an interval of 330 feet from its top down to the base of the Harlem coal bed.

On the economic geology map accompanying this report are printed contour lines in green that show not only the approximate tidal elevation of the top of the Pittsburgh coal, but the horizontal contours of the troughs, arches and domes, and the dip of the beds. Whether the Pittsburgh coal is above or below drainage at any point in the two counties can readily be determined from this map by noting the elevation of the land surface at the point desired as exhibited by the topographic contours, and the elevation of the coal as shown by the structure contours at the same place. For instance, suppose that the position of the coal was desired at the east edge of Salem, Harrison county. A glance at the map will show that the elevation of the creek there is about 1035 feet above tide, and the tidal elevation of the coal as shown by the green contour lines, about 300 feet. Hence, the Pittsburgh coal should lie about 735 feet below drainage at this point.

These structure contours are only approximately correct from the fact that it is assumed over small areas that the rocks maintain a uniform thickness, when it has often been established that two easily determined strata will vary in interval many feet in a short distance. The last table well illustrates this point.

Again, while a large number of elevations were obtained by spirit level, by far the greater number was obtained with the aneroid barometer. The latter, however, was checked as frequently as possible on established spirit level elevations of the United States Geological Survey, marked at the forks of public highways and other conspicuous places. These checks keep down errors in elevation, so that it is believed that over most of the area their sum is less than one contour interval—that is, less than 25 feet.

Detailed Geologic Structure.

The Doddridge-Harrison area is situated on the eastern flank of the great Appalachian basin or geo-syncline which enters West Virginia near the southwest corner of the State of Pennsylvania. I. C. White[1] gives the following account of this great trough:

> "The central or deepest portion of the Appalachian basin or geo-syncline enters West Virginia from Greene county, Pa., at the southwest corner of the latter State, and crossing Western Monongalia and eastern Wetzel counties continues on through the State in a general southwest course across eastern Tyler, western Doddridge, central Ritchie, Wirt and Jackson, cutting eastern Mason and western Putnam, and central Cabell, to enter Kentucky from northern Wayne, ten miles above the mouth of the Big Sandy river. Where the axis of this great basin enters the State, and on to the southwest as far as Doddridge county at least, the Pittsburgh coal is buried to a depth of 1,300 to 1,500 feet under the highest summits, or say 100 to 150 feet above tide, but from Doddridge county on southwestward, the basin begins to rise, and at the Kentucky line the Pittsburgh coal overlooks the Big Sandy waters from an elevation of 800 feet above tide in the deepest portion of the trough."

---

[1] W. Va. Geological Survey, Vol. II, pp. 84-85; 1903.

Although the two counties lie on the eastern slope of this great geo-syncline, yet their area is traversed by a number of minor folds, the most important of which are as follows:

Anticlines.
Big Moses.
Arches Fork.
Wolf Summit.
Chestnut Ridge.
Beards Run.
Ruraldale.

Synclines.
Burchfield.
Robinson.
Shinnston.
Grassland.

The shape and location of the above structural forms are all indicated on the map accompanying this report. A brief description will now be given of these arches and troughs from west to east.

Big Moses Anticline.—The axis of this fold enters Doddridge county from Tyler, one mile and a half northeast from the mouth of Arnolds creek, and bears southwest, passing into Tyler again and intersecting the Tyler-Ritchie county line on the head of Buck run of North Fork of Hughes river. From the latter point the axis veers more to the south and crosses the Baltimore & Ohio railroad one-third mile west from Tollgate. It was so named by the writer[2] from a town of that name in Tyler county near which it passes in its southwest course across the latter area.

Northward from Doddridge county the axis passes into Tyler, crossing Indian creek 1 mile northeast of Big Moses; the Tyler-Wetzel county line near Atwood P. O.; and Fishing creek, one mile southeast of the town of Reader. From the latter point the fold dies down and finally disappears one mile south of Wileyville, Wetzel county.

Southwestward from Doddridge the axis passes into Ritchie county, passing slightly west of the town of Pullman, veers to the west and slightly west of Washburn P. O. and then renews its southwest course, crossing the Ritchie-Calhoun line on the head of Left fork of Dutchman run, 3¾ miles southwest of Smithville. From the latter point the axis passes into Wirt county one mile southeast of Hartley P. O., and finally dies out on the eastern slope of the Burning Springs anticline, one mile southeast of Creston.

---

[2] Marshall-Wetzel-Tyler Report, W. Va. Geol. Survey, pp. 69-70; 1909.

The elevation of the Pittsburgh coal, along the axis of the fold in that portion included within the Doddridge-Harrison area, varies from 325 feet to about 370 feet above sea level. There appears to be a depression or saddle to the fold north of Orontes post office.

Arches Fork Anticline.—The Arches Fork anticline is a very prominent structural feature in Doddridge county, and it was so designated by the writer[3] from a stream of that name in the southeastern portion of Wetzel county, on which occurs its northeastern terminus. The axis of the fold enters Doddridge from Wetzel county at the extreme head of Talkington fork of McElroy creek, and bears southwest, crossing Robinson fork 2 miles above Centerpoint and Flint run one mile west from Doak P. O. There it deflects slightly more to the west and crosses the Baltimore & Ohio railroad one-half mile west from Morgansville. It intersects South Fork of Hughes river near the mouth of Big run, 2½ miles below Kelly P. O.; then bears south about 10 degrees west, passing one-half mile west of the common corner to Doddridge, Ritchie and Gilmer counties.

Northward from Doddridge the axis passes into Wetzel county, veers to the northwest roughly parallel with Arches fork, and dies down just before reaching Fishing creek into the Smithfield structural terrace, one mile west of the town of Smithfield.

Southward from Doddridge the axis passes into Ritchie county, crossing the extreme eastern point of the latter area, 2 miles east of Auburn, and then veers to the southwest across Gilmer county, and intersects the Gilmer-Calhoun county line, 2¾ miles due north of the village of Whitepine. On entering Calhoun county the axis bears southwest and crosses the Little Kanawha river one mile northwest of Grantsville; West Fork river, one mile northwest of Altizer; Beech fork at Beech P. O.; and the Calhoun-Roane county line, one mile southwest of Beech P. O. Southwestward through Roane county the axis crosses Henry fork at Linden, passes through Nichols knob, and intersects the Roane-Jackson county line 2½ miles westward from Cotton P. O. The course of the fold on southwest across the State through Kanawha and other counties has not yet been worked out in the field.

---

[3] Marshall-Wetzel-Tyler Report, W. Va. Geol. Survey, page 454; 1909.

Where the fold enters Doddridge on the northeast, the top of the Pittsburgh coal bed has an elevation of about 360 feet above tide on the axis of the arch. Southwest from this point along the crest of the anticline the coal gradually rises into a marked dome, two miles east from Centerpoint, to an elevation of over 425 feet above tide. A depression on the crest of the fold apparently occurs on Little Battle run of Big Battle run, where the anticline suddenly broadens out on top to the southwestward making a terrace structure three to four miles wide. A marked **nose** to the fold is formed to the southwest from Big Battle P. O., since the Pittsburgh coal horizon rises rapidly along the axis in this direction to an elevation of over 700 feet above tide at three miles southeast from West Union. The Pittsburgh coal falls rapidly in elevation along the axis southwestward from the point where the axis crosses South Fork of Hughes river, and at the Doddridge-Ritchie county line it is only 600 feet above tide.

Along the crest of this anticline occur the great natural gas fields of Doddridge county, as well as the present developed great natural gas pools in Calhoun and Roane counties of this State.

Wolf Summit Anticline.—The next structural arch to the east that crosses the Doddridge-Harrison area is the Wolf Summit anticline. It has been so designated from the town of that name in Harrison county, West Virginia, near which it passes in its northeast-southwest course across the latter area. The axis of the fold enters Harrison from Marion county, one mile northeast from Wyatt and bears south about 30 degrees west, crossing Little Tenmile creek three-fourths mile above the mouth of the latter stream. It continues the same course about one mile farther to the southwest, where it veers to almost due south, crossing the Baltimore & Ohio railroad at Wilsonburg. From the latter point the axis bears south 10-15 degrees west for three miles where it veers to almost due south again, passing one mile and a half west of the town of West Milford; three-tenths mile east of Goodhope; and intersecting the Harrison-Lewis county line one mile eastward from the mouth of Kincheloe creek.

Northeastward from Harrison county the axis passes into Marion, and crosses Tevebaugh creek, one mile and a half northwest from Festus; Buffalo creek about midway between Downs and Farmington (Underwood); and Pawpaw creek, two miles southeast of Fairview. Northeast from the latter stream the fold dies down rapidly and apparently disappears in the southern edge of Monongalia northwest of McCurdyville (Center P. O.). The Statler Run oil field apparently passes around the nose of the fold as it dies out in this region. While the field notes collected for the Monongalia-Marion-Taylor area have not yet been mapped, the fold, if represented in northern Monongalia, must be very slight.

Southward from Harrison county the axis passes into Lewis and soon dies out on the northwest flank of the Chestnut ridge anticline, as the axis of the latter fold swerves to the westward on leaving the area under discussion.

A glance at the structure map accompanying this report will show that the structural slope of the western flank of this arch is very steep, the top of the Pittsburgh coal rising from about 100 feet above tide near the northwestern corner of Harrison county to over 1175 feet above tide, two miles due west from Lumberport, in an air line distance of slightly less than 9 miles. The structural slope along the eastern flank is much more gentle. From where the fold enters Harrison from Marion county the Pittsburgh coal bed rises rapidly southwest along the axis from 925 feet above tide to slightly over 1175 feet above in a marked dome, 2 miles west from Lumberport. South from Tenmile creek this coal bed rises quite rapidly again along the axis into another prominent dome to an elevation of 1280 feet on Coburn creek, 3 miles south 10-15 degrees west from Wilsonburg. From this high point, the Pittsburgh coal dips southward along the axis to an elevation of about 1240 feet above tide, 2 miles northwest from West Milford, where it rises rapidly again southward, forming a nose of the fold, and reaches over 1400 feet above tide at the Harrison-Lewis county line. A great natural gas field is found along the crest of this arch throughout its entire length across Harrison county.

Chestnut Ridge Anticline.—The next structural arch to the east in the area under discussion is the great Chestnut Ridge anticline that has been so designated by I. C. White from a mountain ridge of that name along the eastern edge of Monongalia county. It is the same arch that was designated the Dulany anticline by M. R. Campbell in the Masontown-Uniontown Folio No. 82 of the U. S. Geological Survey, page 5. The fold enters Harrison county from Taylor about three miles northeast from Bridgeport, and bears south 40-50 degrees west, crossing Simpson creek near the mouth of Peddler run, and Brushy fork of Elk, one mile and a half east from Quiet Dell. From there the axis continues its southwest course and crosses Elk creek three-fourths mile northwest from the mouth of Fall run, passing one-half mile to the east of the town of Rockford and intersecting the Harrison-Lewis county line one mile and a half westward from the common corner to Harrison, Lewis and Upshur counties. It is probably the longest continuous anticlinal fold within the boundaries of the State, and in the writer's judgment, the Warfield anticlinal, located southwest from the Great Kanawha river, will later be found to be merely an extension of the Chestnut Ridge arch.

Northeastward from Harrison county the axis passes into Taylor county, crosses the Tygart Valley river, three-fourths mile below Valley Falls station on the Baltimore & Ohio Railroad, veers more to the east and intersects the Marion-Monongalia county line south from Halleck. In Monongalia the axis passes east of Halleck and follows closely the Monongalia-Preston county line and intersects the W. Va.-Penna. State Line slightly over a mile due east of the northwest corner of Preston county.

Southwestward from Harrison the axis passes into Lewis county, veers rapidly to the westward through Gilmer and enters Calhoun county, three-fourths mile eastward from the eastern point of Lee district. In Calhoun the axis passes near Walnut and Stinson and enters Roane 3 miles northeast of Uler. It continues its same southwest course across the latter county and intersects the Roane-Kanawha county line one-half mile westward from the common corner to Roane, Clay and Kanawha counties. From the latter point the fold has not yet been traced southwest across the State, but as mentioned above, it will probably connect up with the Warfield anticline.

Where the anticline enters Harrison from Taylor, the top of the Pittsburgh coal bed has an elevation of about 1470 feet above tide, but from there the coal dips rapidly southwest along a nose of the fold to an elevation of about 1400 feet A. T. at Simpson creek. From the latter point southwest along the axis the coal remains almost horizontal to Brushy fork of Elk creek, where it rises rapidly to an elevation of over 1525 feet A. T. in a high structural dome, located 2 miles due east from Lost Creek village. The great natural gas field of the Lost Creek region of Harrison county is located near its crest.

Beards Run Anticline.—The Beards Run anticline is the last structural arch to the east in Harrison county, and has been so designated by the writer from the stream of that name along which the axis of the fold passes in western Harrison. This anticlinal is merely a spur projected off from the great Chestnut Ridge arch to the southeast from near the point where the Harrison-Taylor county line crosses Simpson creek. The fold is probably not over 6 to 8 miles in length. It has a northwest-southeast course, and intersects the Harrison-Barbour county line 2 miles southwestward from the common corner to Harrison, Barbour and Taylor counties. While the extent of the Beards Run anticline to the southeast in Barbour county was not definitely determined, yet sufficient data have been obtained to warrant the belief that the fold dies down in this direction on Elk creek about one mile east from the village of Overfield.

Along the axis of this arch, the top of the Pittsburgh coal bed reaches an elevation of about 1360 feet above tide at the Harrison-Barbour county line.

Ruraldale Anticline.—An examination of the structure map accompanying this report will show the occurrence of the nose of another anticline in the extreme southeast corner of Harrison county. Its northern terminus is located about two miles eastward from Johnstown, same county, from which place the axis of the fold bears southward in the direction of Ruraldale P. O. on the head of Hackers creek, Upshur county. Hence, for lack of a better name in this portion of the fold, the writer has designated it the "Ruraldale" anticline.

Where the axis of the arch crosses the Harrison-Upshur county line, the top of the Pittsburgh coal bed has been elevated to about 1370 feet above tide. Its form, shape and accurate location southward from the latter point in Upshur has not yet been ascertained by the Survey.

There are only four specially prominent synclines in the Doddridge-Harrison area, as listed above. A brief description will now be given of the same, from west to east in order.

Burchfield Syncline.—This structural basin lies immediately east from the Big Moses anticline in western Doddridge county, and was so designated by the writer[4] from a town of that name in eastern Wetzel county, West Virginia, near which it passes in its north and south course in the State. The axis of the fold enters Doddridge from Tyler county slightly over a mile due south of Stringtown (Alvy P. O.), and bears south about 30 degrees west, crossing McElroy creek one mile above Eagle Mills P. O., and Little Flint run, one-half mile north of Canton P. O. The axis continues the same course to its intersection with Middle Island creek, one-half mile below the mouth of Piggin run and slightly over a mile northwest from the town of West Union. From Middle Island creek the axis veers more to the westward, passing through Central Station. From the latter point it veers to nearly its former course, intersecting with Cabin run of North

---

[4] Marshall-Wetzel-Tyler Report, pp. 64-65, W. Va. Geol. Survey; 1909.

Fork of Hughes river, one-fourth mile eastward from Joy P. O., and crosses the Doddridge-Ritchie county line one mile and a half northwest from the town of Oxford.

Northward from Doddridge, the axis passes into Tyler and crosses Indian creek of Middle Island near Stringtown (Alvy P. O.); and the Tyler-Wetzel county line 3 miles northeast of the latter village. It continues its northeast course through Wetzel and crosses Fishing creek 2½ miles northwest of Smithfield; Willey fork at Burchfield; Fish creek, 2 miles northwest of Hundred; and the W. Va.-Penna. State line, 2¾ miles due east of the southwest corner of Pennsylvania. The fold has never been named in Pennsylvania.

Southwestward from Doddridge, the axis passes into Ritchie county, passes 1.5 miles north of Berea, and one mile southeast of Smithville, and crosses the Ritchie-Calhoun county line, 2½ miles north 20-25 degrees east of Freed P. O. It continues this southwest course in Calhoun, crosses the Little Kanawha river 2 miles above the mouth of Leading creek, and finally dies out on the north slope of the Burning Springs anticline where the axis of the latter fold veers to the eastward in Calhoun county.

Where the axis of the trough enters Doddridge from Tyler county, the elevation of the top of the Pittsburgh coal horizon is slightly less than 200′ A. T. From this place the coal gradually rises to an elevation of 325 feet above tide southwest along the axis to the latter's intersection with Nutter fork of Middle Island creek, where it changes to an almost horizontal position to near the West Union-Central district line, 1¼ miles northeast from Central Station. From this line the coal dips rapidly southwest along the axis into a deep canoe-shaped structural basin and at the Doddridge-Ritchie county line is slightly less than 250 feet above tide. From the latter point it again rises rapidly southwest along the axis of the trough.

Robinson Syncline.—The Robinson syncline is the deep structural basin that lies between the Arches Fork and Wolf

Summit anticlines and was so designated by the writer[5] from a town of that name in the southeastern corner of Wetzel county, West Virginia, near which it passes on its northeast-southwest course across the latter area. When the writer first described this basin in the Marshall-Wetzel-Tyler report, mention was there made of the probability of this basin's being an extension of the Waynesburg syncline of Greene county, Pennsylvania, but during the season of 1911 the field work for the western portion of Marion and Monongalia county was completed, and it is found that the Robinson syncline extends north 10-20 degrees east from its type locality via Seven Pines, and passes slightly east from Glover Gap tunnel. From the latter region it follows closely along the Wetzel-Monongalia county line, and crosses the West Virginia-Pennsylvania State line near the northwest corner of Monongalia county. On the other hand, Stone & Clapp[6] show the axis of the Waynesburg syncline intersecting the same State line about six miles farther eastward, near the mouth of Pumpkin run of Dunkard creek; hence, the Robinson and Waynesburg synclines represent separate and distinct basins. The latter parties failed to name the former trough at its northern terminus in western Springhill township, so that the name "Robinson" holds by right of priority.

The axis of the latter fold enters the northwestern corner of Harrison from Wetzel county, bears slightly west of south, and crosses the W. Va. Short Line Branch of the Baltimore & Ohio Railroad at Rinehart station. From there it continues almost due south to a point about one mile northwest from Fonda P. O. where it veers to a south 30-35 degrees west course, passing about two miles eastward from Sedalia and three-fourths mile east from Cascara, and intersecting with the main line of the Baltimore & Ohio railroad, two miles west from Salem. There the axis of the trough swings slightly more to the west and crosses Buffalo Calf fork, one mile and three-fourths southeast from Long Run station; Buckeye fork, one-third mile northwest from Nina P. O.; and Meathouse fork, two miles southeast from the town of New Milton, near the mouth of Brushy fork. It still continues nearly the same southwest course, and crosses Cove creek one-third mile north of Leopold P. O., and the Doddridge-Gilmer county line 2¾ miles eastward from the common corner to Doddridge, Ritchie and Gilmer counties.

---

[5] Marshall-Wetzel-Tyler Report, page 69, W. Va. Geol. Survey; 1909.

[6] Bul. 304, Structure Map of Greene Co., Penna., U S. Geol. Survey.

Southwestward from Doddridge the axis passes through Gilmer county and intersects the Gilmer-Calhoun county line one mile northeast of the village of Whitepine. In Calhoun it bears south about 30 degrees west; passes through Sycamore P. O., and near Arnoldsburg; and crosses the Calhoun-Roane county line 2 miles eastward from Linden. In Roane the axis bears southwest, passing near Tariff, Bright, Lefthand and Clio post offices, and crosses the Roane-Kanawha county line 1¾ mile westward from Cotton P. O. Its course on southwest across the State has not yet been accurately traced.

Where the axis of the basin enters Harrison from Wetzel county, the Pittsburgh coal bed has an elevation of only 120 feet above tide, but it rises southwest along the axis to an elevation of 200′ A. T., a short distance south from Rinehart. From there the bottom of the trough flattens out to a width of 2 to 3 miles to the region west of Salem, on which the Pittsburgh coal bed is nearly horizontal, approximating an elevation of 200′ A. T. From the region west of Salem, however, the Pittsburgh coal rises rapidly southwestward along the axis of the basin to slightly over 250′ A. T., and then remains almost horizontal to a point one mile and a fourth southeast from Market P. O. There it dips slightly to the southwest for two to three miles, and again rises rapidly and at the Doddridge-Gilmer county line, the coal has an elevation of about 415′ A. T.

Shinnston Syncline.—This structural basin lies between the Wolf Summit and Chestnut Ridge anticlines, and has been so designated by the writer from the town of Shinnston, Harrison county, through which it passes. In eastern Monongalia county, the structural basin immediately west of the Chestnut Ridge anticline has been described by geologists as the Uniontown (Connellsville) syncline, but there the Indiana (Fayette) anticline, immediately to the west, suddenly terminates the latter syncline in its southwest course by its intersection with the Chestnut Ridge arch near Clinton Furnace, Monongalia county. Likewise the Lambert syncline, next on the west from the Indiana (Fayette) anticline, soon dies out after crossing the Monongalia river from Fayette into Greene county, Pennsylvania. Hence, it follows that the Shinnston syncline has no equivalent to the northeastward, and that the latter name should hold by the right of priority.

The axis of this basin enters Harrison county from Marion one mile westward from the mouth of Bingamon creek, bears almost due south through the town of Shinnston, and crosses Simpson creek three-fourths mile eastward from Meadowbrook. From there it veers slightly to the west, crosses Elk creek at the east edge of Clarksburg, and then swings to the southwest to near Lynch Mines at the mouth of Browns run of West Fork river. There it changes to a southward course, passes one-fourth mile west of Mt. Clare, and crosses Lost creek two miles northwest from the town of Lost Creek, and the Harrison-Lewis county line about two miles westward from McWhorter.

Northward from Harrison the axis passes into Marion county and crosses Buffalo creek 2 miles eastward from Farmington; Pawpaw creek, near Stafford; the Marion-Monongalia county line, west of Arnettsville; and finally dies out one mile northwest of Georgetown on the west slope of the Indiana (Fayette) anticline.

Southward from Harrison county the Shinnston syncline passes into Lewis, but dies out shortly on the steep northwest slope of the Chestnut Ridge anticline.

When the axis of the basin enters Harrison from Marion county, the top of the Pittsburgh coal bed has an elevation of about 850′ A. T., but the coal rises rapidly southward along the axis of the syncline to an elevation of 910 feet at

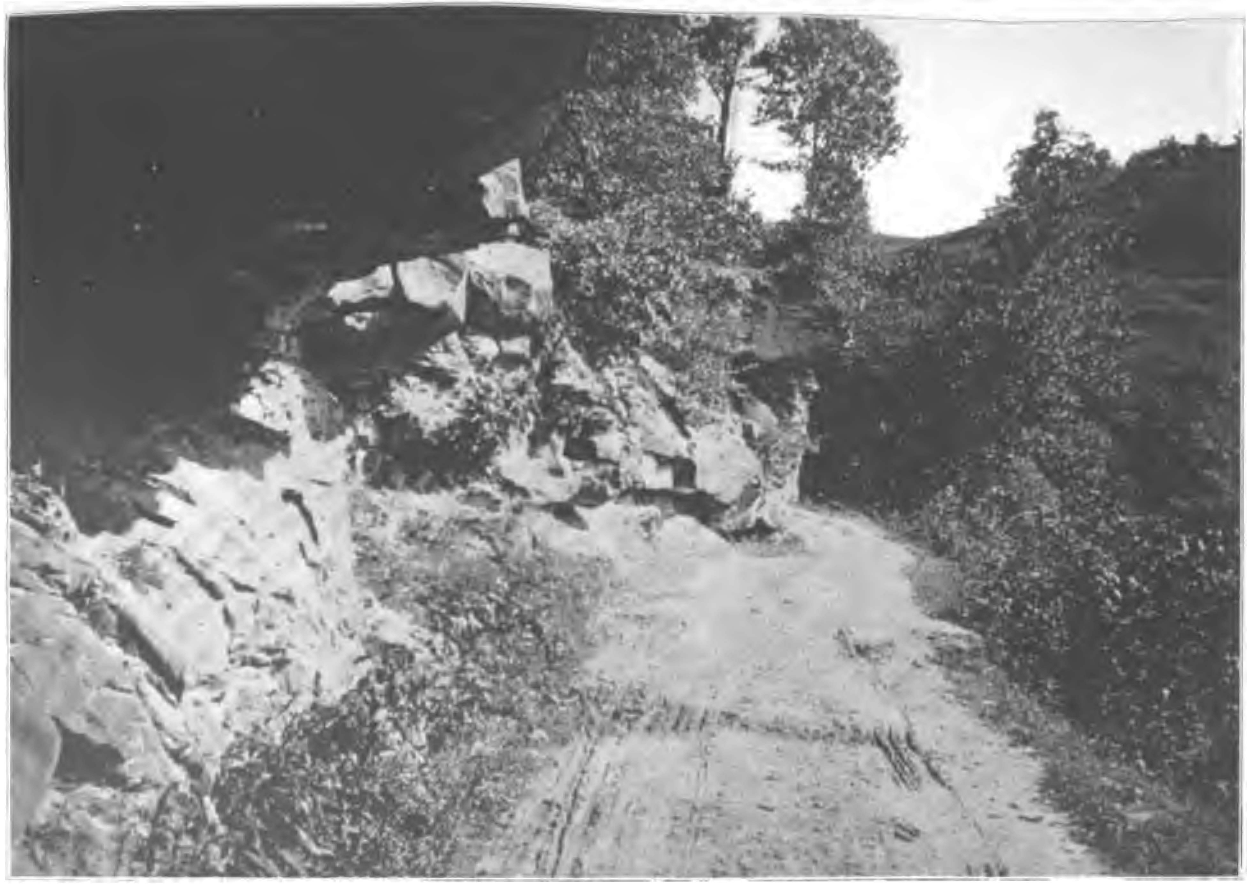


PLATE V.—Lower Pittsburgh Sandstone cropping along road leading down Bingamon creek, one mile eastward from Peora.

Shinnston; 950 feet at Meadowbrook; 1080 feet at Clarksburg; 1105 feet at Lynch Mines; 1140 feet near Mt. Clare; and 1360 feet above tide at the Harrison-Lewis county line. The rapid rise of the axis to the southward in Harrison is due to the gradual convergence in this direction of the axes of the Wolf Summit and Chestnut Ridge anticlines.

Grassland Syncline.—In the Doddridge-Harrison area, the next structural fold immediately on the east of the Chestnut Ridge anticline, and west of the Beards Run and Ruraldale anticline, is the Grassland syncline. The latter has been so designated by the writer from a postoffice of that name through which the axis passes, located in the southeast corner of Simpson district, Harrison county. The northeastern terminus of the trough is located 2½ miles north of Tyrconnell Mines station in Taylor county. This portion of the basin lies between the main Chestnut Ridge anticline on the west and the Beards Run anticline on the east, the latter arch, as mentioned on page 59, being merely a spur off the former anticline. The axis of the Grassland syncline enters Harrison from Taylor county one mile and a quarter northeast from Oral station, bears south 10-15 degrees west, following closely Douglas run of Beards run to its head, and crosses Brushy fork of Elk creek at Grassland P. O. From the latter point the axis continues the same course and crosses Elk creek one-half mile westward from the Harrison-Barbour county line and Gnatty creek, 2½ miles northwest from the common corner to Harrison, Barbour and Upshur counties. There it veers more to the west, passes about one mile southeast from Johnstown, intersects the Harrison-Upshur county line one-half mile eastward from Rooting creek, and crosses Hackers creek three-fourths mile eastward from the Upshur-Lewis county line. In Pennsylvania and northern West Virginia the name **Ligonier** has been applied to the basin east of the Chestnut Ridge anticline. The Grassland syncline, however, is only a spur off the main Ligonier basin to the eastward.

Where the axis of the syncline intersects the Taylor-Harrison county line, the Pittsburgh coal horizon has an elevation of slightly over 1400′ A. T., but from this place the coal dips rapidly southwest along the axis of the trough, and at a point two miles southward from Grassland P. O., it has an elevation of only 1200′ A. T. From this low portion of the basin, the Pittsburgh coal bed rises gently southwest along the axis of the syncline, and at the Harrison-Upshur county line, it has an elevation of about 1255′ A. T.

A glance at the structure contours of the top of the Pittsburgh coal bed as shown by the economic geology map accompanying this report, will show that the strata of the Doddridge-Harrison area are very much warped and twisted, and that ideal conditions prevail for the segregation of petroleum and natural gas into pools of commercial value. It will also show that this feature is directly responsible for a large reduction of the original area of the Pittsburgh coal bed along the crests of the Wolf Summit and Chestnut Ridge anticlines.

CHAPTER IV.

STRATIGRAPHY—GENERAL SECTIONS.

Introduction.

The stratified or sedimentary rocks of the earth's surface have been classified by geologists into divisions based mostly on the animal and vegetable life of the past ages as preserved in a fossil state in the rocks themselves. The principal divisions of the rock column, so constructed on these characters, are as follows:

Cenozoic—Recent life forms.
Mesozoic—Less recent forms.
Paleozoic—Oldest forms of life.
Archean—Generally crystalline rocks without fossils and direct evidence of life, largely destroyed.

The surface rocks in West Virginia are mostly included in the Paleozoic division, and by far the greater portion of the area of the State consists of rocks belonging to one subdivision of this era; viz., the Carboniferous.

The subdivisions or ages of the Paleozoic are:

- **Carboniferous**
  - Upper
    - Permian.
    - Coal Measures, or Pennsylvanian.
  - Lower Subcarboniferous, or Mississippian.
- **Devonian.**
- **Silurian.**
- **Ordovician.**
- **Cambrian.**

In the Doddridge-Harrison area, the cropping stratified rocks belong wholly in the Upper Carboniferous, and the exposed beds are all above the base of the Conemaugh series. The following table exhibits the several subdivisions of the stratified rocks in northern West Virginia:

UPPER CARBONIFEROUS.

Dunkard, or Permo-Carboniferous Series (1100 to 1200 feet).
Monongahela Series (260 to 400 feet).
Conemaugh Series (500 to 600 feet).

Allegheny Series (225-350 feet).

(Not cropping in Doddridge-Harrison Area.)

Upper Freeport Coal.
Upper Freeport Limestone.
Bolivar Fire-clay.
Upper Freeport Sandstone.
Lower Freeport Coal.
Lower Freeport Limestone.
Lower Freeport Sandstone.
Upper Kittanning Coal.
Middle Kittanning Coal.
Lower Kittanning Coal.
Lower Kittanning Clay.
Lower Kittanning Sandstone.
Vanport (Ferriferous) Limestone.
Clarion Sandstone.
Clarion Coal.
Clarion Clay.

Pottsville Series (Northern Section, 250-300 feet).

(Not cropping in Doddridge-Harrison Area.)

Homewood Sandstone.
Mt. Savage Fire-clay.
Mt. Savage Coal.
Upper Mercer Coal.
Lower Mercer Coal.
Upper Connoquenessing Sandstone.
Quakertown Coal.
Lower Connoquenessing Sandstone.
Sharon Coal.
Sharon Conglomerate.

LOWER CARBONIFEROUS.

(Not cropping in Doddridge-Harrison Area.)

Mauch Chunk Shales (40 to 250 feet).
Greenbrier Limestone (15 to 100 feet).
Pocono Sandstone (400 to 600 feet).

DEVONIAN.

Catskill Sandstones (Venango Oil Group, 300 to 500 feet).

Chemung and Hamilton Shales, penetrated in Wheeling deep well to a depth of nearly 2,000 feet below the Venango Oil Sand Group without reaching the Carboniferous Limestone.

The order and character of the several formations composing the rock column in the Doddridge-Harrison area, will now be illustrated by sections made both from exposure at crop, and from the logs of the numerous borings for petroleum and natural gas throughout the two counties.

DODDRIDGE COUNTY SECTIONS.

McClellan District.—The following section was measured by the writer in the extreme northern portion of Grant district with aneroid from the summit of a high knob near the common corner to Doddridge, Wetzel and Harrison counties, along a hill road leading west on Talkington fork, and tied to the Smith & Robinson No. 1 well (1). The formations as recorded are thinner than they should be for the reason that the measurements were made in descending order along the rise of the strata for a distance of one mile, thus shortening the true vertical interval by about 50 feet:

Heldreth P. O. Section, McClellan District.

Upper Carboniferous (1268')	Thickness. Feet.	Total. Feet.
Dunkard Series (873')		
Concealed from top of knob	100	100
Concealed with sandstone to corner of 3 counties	65	165
Shale	5	170
Sandstone, massive, green	15	185
Shale, sandy	9	194
Fire clay	1	195
Shale and concealed	15	210
Shale, red	4	214
Fire clay (3")	1	215
Shale	5	220

	Thickness. Feet.	Total. Feet.	
Sandstone, shaly	5	225	
Concealed	10	235	
Shale, red and variegated	20	255	
Sandstone, shaly	5	260	
Concealed and shale	15	275	
Sandstone, massive, coarse, brown	35	310	
Shale, sandy and red	10	320	
Sandstone, massive	5	325	
Concealed	29	354	
Fire clay	1	355	
Concealed	25	380	
Shale, yellow and sandy	10	390	
Concealed	10	400	
Shale	5	405	
Sandstone, massive	10	415	
Unrecorded to the top of well (1)	220	635	
Smith & Robinson No. 1 Well Record (1).			
Unrecorded from top of hole	238	873	873'
Monongahela Series (395')			
Unrecorded	382	1255	
Coal, Pittsburgh	13	1268	395'

The following section was obtained by combining the log of the J. Hudson[1] diamond drill boring (21) located at the mouth of East run, 1.2 miles northwest from Sedalia, with a section measured with aneroid by Mr. D. B. Reger, Field assistant, southwest from the summit of a high knob one mile southeast from Centerpoint, down the hill towards Robinson fork:

Section Northwest of Sedalia, McClellan District.

Upper Carboniferous (856.33')	Thickness. Feet.	Total. Feet.	
Dunkard Series (466')			
Shale, brown, capping knob and concealed	20	20	
Sandstone, green and flaggy	25	45	
Concealed and red shale	105	150	
Sandstone, brown, flaggy, micaceous, Upper Marietta	50	200	200'
Concealed and red shale	15	215	
Concealed, mostly sandstone	35	250	
Shale, red, Creston	40	290	
Sandstone, brown, friable, Lower Marietta	15	305	
Shale, brown and concealed	25	330	
Coal blossom, Washington (2")	0	330	130'
Concealed	40	370	
Sandstone, yellowish, brown, medium grained and hard, Mannington	30	400	
Concealed	5	405	

---

1. Vol. II, page 138, W. Va. Geol. Survey; 1903.

Hudson Boring Log.	Ft.	In.			
Surface	27	0	61	466	136′
Blue sand shale	5	0			
Red shale	12	0			
Sandstone	2	0			
Blue shale	2	0			
Blue shale	2	0			
Sandstone	5	0			
Blue sand shale	6	0			
Monongahela Series (390.33′)					
Black and gray shale, Waynesburg coal horizon			2	468	
Blue shale	4	0	116.7	584.7	118.7′
Sand shale	12	0			
Sandstone, Gilboy	14	0			
Sandstone, Uniontown	69	0			
Blue shale	17	8			
Coal, Uniontown					
coal	0	8	3.2	587.9	
shale partings	1	3			
coal	1	3			
Blue Shale	15	2	184.1	772	
Lime and shale mixed	7	0			
Lime and shale	31	0			
Red shale	6	0			
Lime and shale	4	0			
Soft blue shale	4	0			
Blue shale	8	0			
Limestone, (Benwood)	52	0			
Blue shale	29	0			
Blue shale	28	0			
Coal, Sewickley			0.5	772.5	187.8′
Soft white shale	0	6	77	849.5	
Blue shale	6	0			
Red shale	4	0			
Blue shale	4	0			
Green shale	10	0			
Blue shale	5	0			
Red shale	2	0			
Soft white shale	3	0			
Sandy shale	10	0			
Sand shale	2	0			
Sandstone, (Upper Pittsburgh)	26	0			
Black shale	2	0			
Shale	2	6			
Coal, Pittsburgh			6.83	856.33	83.83

In Vol. II, page 138, of the State reports, Dr. White doubtfully refers the formation at 466 feet from the top of the section as representing the Waynesburg "A" coal horizon, but the addition of the part above the top of the boring, shows that this stratum represents the Waynesburg bed; hence, the formations 16 feet below the Waynesburg coal probably represent both the Gilboy and Uniontown sandstones combined, and the thickness of the Monongahela series, instead of being 457 feet, 4 inches, is only 390 feet, 4 inches. The boring is very important, in that it gives the thickness of the great Pittsburgh coal bed within two miles of the western boundary line where the latter coal of commercial thickness and purity disappears.

The following record of a well drilled for oil and gas by the South Penn Oil Company, located near the mouth of Franks run of McElroy creek, and published in Vol. I, pp. 328-329 of the State Survey reports, gives the detailed rock succession down to almost 100 feet in the Pocono sandstone series. The well starts 50 feet, hand level measurement, below the base of the Washington coal bed:

Section One Mile N. W. of Centerpoint, McClellan District.
(Sullivan Heirs No. 1 Well Record (71).

Upper Carboniferous (1601')	Thickness. Feet.	Total. Feet.	
Dunkard Series (80')			
Top rock	20	20	
Red rock	50	70	
Slate	10	80	80'
Monongahela Series (414')			
Slate	17	97	
Sandstone, (Gilboy)	26	123	
Red rock and slate	12	135	
Slate	15	150	
Sandstone (Uniontown)	5	155	
Red rock	17	172	
Slate	15	187	
Coal, (Uniontown)	8	195	115'
Sandstone	18	213	
Slate	7	220	
Limestone	98	318	
Slate and shells	101	419	
Coal, (Sewickley)	6	425	230'
Slate	12	437	
Limestone, (Sewickley)	24	461	
Slate	33	494	69'
Conemaugh and Allegheny Series (804)			
Sandstone (Lower Pittsburgh)	31	525	
Limestone (Upper Pittsburgh)	6	531	
Sandstone	28	559	
Slate	47	606	
Sandstone, (Connellsville)	30	636	142'
Red rock	8	644	
Limestone	50	694	
Red rock	20	714	
Limestone	69	783	147'
Red rock (Pittsburgh)	27	810	
Limestone	41	851	
Slate	16	867	

	Thickness. Feet.	Total. Feet.	
Limestone	37	904	
Slate	11	915	
Limestone	7	922	
Slate	90	1012	
Sandstone, Dunkard, Mahoning and Upper Freeport	101	1113	330′
Limestone	54	1167	
Sand, gas, "Gas sand" (Lower Freeport)	28	1195	
Slate, "break"	22	1217	
Sand, gas, "Gas sand" (Lower Freeport)	40	1257	
Limestone	51	1308	195′
Pottsville Series (293′)			
Salt sand (Homewood and Connoquenessing)	168	1476	
Limestone	12	1488	
Sandstone	28	1516	
Slate and shells	59	1575	
Sandstone	26	1601	293′
Lower Carboniferous (309′)			
Mauch Chunk Series (164′)			
Slate	9	1610	
Limestone	40	1650	
Red rock	36	1686	
Limestone	13	1699	
Red rock	11	1710	
Slate	9	1719	
Limestone	31	1750	
Slate, "cave" ("Pencil")	15	1765	164′
Greenbrier Limestone (58′)			
Limestone, (Mountain) (Big Lime)	58	1823	58′
Pocono Sandstones (87′)			
Sand, gray, "Keener"....13′ Slate .... 2 Sand, white .... 20 Sand, dark gray .... 12 Sand, white (oil pay at 1910′) .... 40 "Big Injun"	87	1910	87′

The well starts 425 feet below the top of a high knob northeast of the well, so that the total thickness of the Dunkard series of rocks, represented in this region, is about 500 feet. Since the Upper Freeport coal, coming at the top of the Allegheny series, is not represented in the well, it is not possible to determine definitely the base of the Conemaugh, but it appears that the Mahoning and the Upper Freeport sandstones have combined into one great ledge, 101 feet thick. The Lower Freeport sandstone is separated into two divisions. This happens quite frequently both in northern West Virginia and Pennsylvania. The break generally holds the Upper Kittanning coal bed.

The several thick ledges of limestone, recorded by the drillers, are probably mostly hard limy shale.

The following section was measured with aneroid by Mr. Reger from the top of a high knob one mile and a half south from Big Battle P. O. in the southwestern edge of McClellan district, northward down the hill road:

Section 1.5 Miles South of Big Battle P. O., McClellan District.

	Thickness. Feet.	Total Feet.	
Dunkard Series (382')			
Concealed from top of knob	10	10	
Shale, red	50	60	
Shale, brown	30	90	
Fire clay, streak, (Dunkard coal horizon?)	0	90	
Shale, red	20	110	
Sandstone, fine, brown, flaggy (Jollytown)	33	143	
Fire clay (Jollytown coal horizon?)	2	145	145'
Shale, variegated	30	175	
Shale, green	5	180	
Shale, red limy	5	185	
Sandstone, shaly, to road at low gap	5	190	
Shale, variegated, ferriferous at top	10	200	
Concealed	10	210	
Fire clay streak, (Hundred coal horizon?)	0	210	65'
Sandstone, gray and flaggy	15	225	
Concealed	5	230	
Sandstone, hard, greenish gray, massive	15	245	
Slate, gray	5	250	
Concealed, mostly red shale	130	380	
Coal, Washington, estimated	2	382	172'

The several streaks of fire clay appear to represent the thin coals of the northern end of the State. The only coal bed of the Dunkard series to attain minable thickness in Doddridge county is the Washington seam. The section stops about 130 feet above the base of the latter series.

GRANT DISTRICT.—Grant district lies immediately southwest from McClellan. Several general sections will now be given therein to show the rock succession.

The following is the detailed log of a well drilled for oil and gas by the South Penn Oil Company in the northwest corner of Grant district, 1.5 miles northeast from Canton P. O. The record, with some modifications in parentheses by the writer, is as published by I. C. White in Vol. I, pp. 332-334. The well starts 15 to 20 feet below the Washington coal bed:

Section 1.5 Miles Northeast of Canton, Grant District.

(J. D. McReynolds No. 1 Well Record (89).)

Upper Carboniferous (1548')	Thickness. Feet.	Total. Feet.	
Dunkard Series (110')			
Conductor (surface gravel)	18	18	
Limestone	40	58	
Red slate	10	68	
Limestone	25	93	
Sandstone and limestone	17	110	110'
Monongahela Series (360')			
Sandstone and limestone	58	168	
Coal, Uniontown)	2	170	60'
Limestone	10	180	
Red slate	15	195	
Limestone	104	299	
Slate, black	18	317	
Limestone	10	327	
Slate, red	16	343	
Sandstone, (Sewickley)	41	384	214'
Slate, red	10	394	
Limestone	26	420	
Coal, Pittsburgh? (Redstone)	4	424	
Limestone and sandstone	46	470	86'
Conemaugh Series (565')			
Limestone and sandstone	71	541	
Slate	50	591	
Sandstone	10	601	
Slate	33	634	
Limestone	25	659	
Slate, red	5	664	
Slate, blue	75	739	
Sandstone and limestone	96	835	365'
Slate, red (Pittsburgh)	30	865	
Sandstone	25	890	
Slate	45	935	
Sand, Dunkard? (First Cow Run), (Buffalo)	20	955	
Slate	10	965	
Limestone and sandstone (Dunkard), (Mahoning)	50	1015	
Slate	20	1035	200'
Allegheny Series (273')			
Limestone	108	1143	
Slate	95	1238	
Sandstone (Clarion)	50	1288	
Slate	20	1308	273'
Pottsville Series (240')			
Sandstone (Second Cow Run) (Homewood)	22	1330	
Limestone	25	1355	
Sand, ("Salt"?) (Upper Connoquenessing)	30	1385	
Slate	30	1415	
Sand ("Salt"?) (Lower Connoquenessing)	63	1478	
Slate, black	20	1498	
Sandstone, (Sharon)	50	1548	240'
Lower Carboniferous (752')			
Mauch Chunk (192')			
Slate, blue	30	1578	

	Thickness. Feet.	Total. Feet.	
Slate, red	75	1653	
Slate, black	25	1678	
Limestone	22	1700	
Sand (Maxton)	40	1740	192′
Greenbrier Limestone (53′)			
Big Lime, Mountain	53	1793	53′
Pocono Sandstones (507′)			
Sand, Big Injun	117	1910	
Slate	40	1950	
Sand, (Squaw)	10	1960	
Slate	30	1990	
Sandstone and limestone	110	2100	
Slate	100	2200	
Limestone	60	2260	
Sand, (Berea Grit)	40	2300	507′
Devonian (*220′*)			
Catskill Sandstones (220′)			
Slate	150	2450	
Limestone	50	2500	
Slate	12	2512	
Sand, "Thirty-foot"? (Gordon stray) to bottom	8	2520	220′
Oil show at 2517′; gas at 2520′.			

In the above section, where two different names are given for the same sand in parentheses, the first is that generally used by the oil and gas drillers, and the second its geologic name. The coal at 420 feet, identified by the drillers as the Pittsburgh bed, must represent the Redstone vein, since the former in this region occurs 500 to 520 feet below the Washington coal, and the latter bed is only 20 feet above the top of the hole. Again, the coal at 168 feet undoubtedly represents the Uniontown seam, and in the vicinity of Long Run and northward in Doddridge, the Pittsburgh coal comes 300 feet below the Uniontown; hence, the base of the Monongahela series should occur at about 470 feet in the well.

The following section was obtained one mile northwest from Long Run station, Grant district, by combining a hand level section[2] measured by the writer at that place with the log of the J. D. Crabtree No. 1 well (126), furnished by the South Penn Oil Company and published in Vol. I, pages 325-326, of the State Survey reports. In the section the part measured by hand-level extends down to about 20 feet below the top of the well:

---

[2] Wirt-Roane-Calhoun Report p. 177 W. Va. Geol. Survey; 1911.

Section One Mile Northwest of Long Run, Grant District.

Carboniferous, Upper and Lower (2740')	Thickness. Feet.	Total Feet.	
Dunkard Series (286')			
Concealed from top of knob (estimated at).	160	160	
Coal, Washington (old mine, fallen shut)...	2	162	162'
Fire clay and green lime shale............	7	169	
Concealed and sandstone, Mannington......	40	209	
Concealed (containing Waynesburg "A" coal horizon)	5	214	
Concealed and sandstone..................	26.4	240.4	
Concealed and reds.......................	10	250.4	
Sandstone, Waynesburg, nodular at top, concealed and reds....................	36	286.4	124.4'
Monongahela Series (409')			
Fire clay and trace of dark shale Waynesburg coal horizon)....................	0.8	287.2	
Reds	10	297.2	
Sandstone, coarse, brown at bottom, Gilboy..	31.6	328.8	
Fire clay and yellowish shale..............	10	338.8	
Sandstone, massive, coarse, brown and pebbly, Uniontown	36.8	375.6	
Shale, gray..............................	1.4	377.0	
Coal, good............1' 3"			
Slate, gray, streaks of coal ....0 8 } Uniontown..	2.7	379.7	93.3'
Coal, slaty............0 10			
Fire clay and concealed to Long run level..	5.3	385	
J. D. Crabtree No. 1 Well Log (126).			
Slate and limy shells (top of formation 20' below top of hole)...................	65	450	
Slate	135	585	
Sandstone, White (Sewickley)............	20	605	225.3'
Slate	30	635	
Sandstone, white, (Upper Pittsburgh).....	60	695	
Coal, trace, Sewickley? (Pittsburgh)......	..	695	90'
Conemaugh Series (565')			
Slate	15	710	
Sandstone, (Lower Pittsburgh)............	20	730	
Slate	68	798	
Coal, Little Clarksburg..................	3	801	106'
Slate and shells.........................	184	985	
Sandstone, black, (Grafton)...............	10	995	194'
Slate	115	1110	
Red rock.................................	97	1207	
Sand, "Hurry Up" (Big Dunkard) (Mahoning)	46	1253	
Slate	7	1260	265'
Allegheny Series (284')			
Slate	85	1345	
Sand, Dunkard? Mahoning? (Gas sand) (Lower Freeport)......................	45	1390	
Slate	63	1453	
Coal, Upper Freeport? (Lower Kittanning)	5	1458	198'
Slate	31	1489	
Sand, gas (Clarion).......................	45	1534	
Slate	10	1544	86'

	Thickness. Feet.	Total. Feet.	
Pottsville, and Mauch Chunk (461′)			
Sand (Second Cow Run) (Homewood)	59	1603	
Slate	19	1622	
Sand, "Salt", (Conoquenessing)	143	1765	
Slate, shells and limestone	230	1995	
Slate, "Pencil"	10	2005	461′
Greenbrier Limestone (77′).			
Big Lime, Mountain	77	2082	77′
Pocono Sandstone (658′?)			
Sand, Big Injun	79	2161	
Slate and sand, light and shells	148	2309	
Sand, dark, Squaw	122	2431	
Slate	298	2729	
Sand, Berea?	11	2740	658′
Devonian (326′)			
Catskill Sandstone (326′)			
Slate	67	2807	
Sandstone	4	2811	
Slate	2	2813	
Sandstone	3	2816	
Slate, light	72	2888	
Slate, pink	5	2893	
Sand, gray, Thirty-foot? (Gordon Stray)	2	2895	
Slate, black, to bottom	171	3066	326′

In that portion of the section taken from the Crabtree well log, several corrections in the correlation of the record as originally published are added in parentheses. Only a trace of the Pittsburgh coal is noted in the well at 695 feet from the top of the section, while the coal, 106 feet lower, correlates with the Little Clarksburg bed of the Conemaugh series, and not the Pittsburgh.

The following section was measured by Mr. Reger with aneroid in the extreme eastern end of Grant district, on the head of Flint run:

Section One Mile Northwest of Numan P. O., Grant District.

	Thickness. Feet.	Total. Feet.	
Dunkard Series (450′)			
Concealed from top of high knob to road, low gap	230	230	
Concealed	5	235	
Sandstone, gray and flaggy	15	250	
Shale, red	5	255	
Sandstone	10	265	
Shale, red	15	280	
Sandstone, shaly	5	285	
Red shale and concealed	15	300	
Sandstone, shaly	10	310	
Fire clay, streak	..	310	310′
Shale, brown	5	315	

	Thickness. Feet.	Total. Feet.	
Concealed and red shale	30	345	
Sandstone, shaly, Upper Marietta	15	360	
Shale, red	7	367	
Sandstone	3	370	
Shale, red	10	380	
Sandstone	5	385	
Shale, brown	10	395	
Sandstone, shaly, Lower Marietta	10	405	
Shale, brown	10	415	
Concealed	35	450	140′
Coal, Washington, edge of road (base is 925′B above tide).			

The section was measured northwest along the rise of the strata for a distance of three-fourths mile. There the rocks are pitching to the southeast at the rate of 100 feet to the mile; hence the intervals are much shorter than they should be, and the total section should probably measure nearly 525 feet.

WEST UNION DISTRICT.—The district of West Union lies southwest from Grant, and borders the Tyler-Doddridge county line in the region of Camp P. O. The writer measured the followed section with aneroid near West Union, the upper portion of which was secured one mile northwest of the town:

West Union Section, West Union District.

Upper Carboniferous (808.7′)	Thickness. Feet.	Total. Feet.	
Dunkard Series (405′)			
Sandstone, massive, green, micaceous, at low gap over R. R. tunnel	20	20	
Concealed and red shale	45	65	
Sandstone, reds, and sandstone, Hundred	35	100	100′
Reds, dark	28	128	
Sandstone, massive, green, micaceous, medium grained, Upper Marietta	45	173	
Shale, sandy	2	175	
Fire clay, gray (Washington "A" coal horizon)	2	177	
Reds, dark, Creston	83	260	
Sandstone and shale	15	275	
Coal blossom, Washington	..	275	175′
Fire clay shale, Washington	15	290	
Sandstone, massive, Mannington	35	325	
Sandstone and reds	25	350	
Concealed	55	405	130′
Monongahela Series (403.7′)			
Concealed	72	477	
Sandstone, massive, Uniontown	20	497	
Shale, sandy	8	505	

	Thickness. Feet.	Feet. Feet.	
Coal 0'—3" Coal, good 2—8½ Slate, soft, dark 0—4 Coal, good 0—6 } (3'—9½") Uniontown	3.7	508.7	103.7'
Concealed to Middle Island creek at east edge of West Union	5	513.7	
Interval	293	806.7	
Coal, Pittsburgh (No. 163 well)	2	808.7	300'

CENTRAL DISTRICT.—The following section was obtained in the extreme western part of Doddridge county by combining a section measured with aneroid by the writer northward down the hill road to Greenwood, with the log of the Flannagan Heirs[3] well (198), located 1.3 miles southeast from Tollgate, close to the Doddridge-Ritchie county line:

Section Near Greenwood, Central District.

Upper Carboniferous (1960')	Thickness. Feet.	Total. Feet.	
Dunkard Series (480')			
Sandstone, green, micaceous, capping knob, Fish Creek	20	20	
Concealed, mostly reds	70	90	
Reds	25	115	
Sandstone, flaggy, green, micaceous, Hundred	30	145	145'
Concealed	25	170	
Reds	10	180	
Sandstone, green, micaceous, shaly, Upper Marietta	30	210	
Concealed and shale	10	220	
Dark shale, trace (Washington "A" coal horizon)	0	220	75'
Fire clay shale, "Washington A"	10	230	
Reds 35' Sandstone, green broken, Middle Marietta 25 Reds 10' } (Creston Red shale)	70	300	
Sandstone, broken	10	310	
Reds and concealed	10	320	
Sandstone, Lower Marietta	20	340	
Concealed	8	348	
Coal, slaty, Washington	2	350	130'
Fire clay shale, Washington	10	360	
Sandstone, massive, Mannington	20	380	
Concealed	10	390	
(Flannagan Heirs Well Log (198))			
Unrecorded	90	480	130'
Monongahela Series (390')			
Unrecorded	5	485	
Sandstone, (Gilboy)	10	495	

---

[3] Vol. I(A), page 406, W. Va. Geol. Survey; 1904.

	Thickness. Feet.	Total. Feet.	
Unrecorded	45	540	
Sandstone, (Uniontown)	25	565	85′
Unrecorded	35	600	
Sandstone, hard, (Arnoldsburg)	20	620	
Unrecorded	134	754	
Lime	20	774	
Unrecorded	26	800	
Sandstone, blue	10	810	
Unrecorded	50	860	
Lime	10	870	305′
Conemaugh Series (515′)			
Unrecorded	80	950	
Lime	20	970	
Unrecorded	120	1090	
Lime	20	1110	
Unrecorded	35	1145	
Coal, (Harlem)	3	1148	278′
Unrecorded	27	1175	
Red rock (Pittsburgh)	30	1205	
Unrecorded	40	1245	
Coal (Bakerstown)	2	1247	99′
Unrecorded	23	1270	
Sandstone, hard (1st Cow Run) (Buffalo)	30	1300	
Black shales (Brush Creek)	10	1310	
Sandstone (Big Dunkard) (Mahoning)	65	1375	
Lime	10	1385	138′
Allegheny Series (245′)			
Unrecorded	115	1500	
Slate and shells	130	1630	245′
Pottsville Series (330′)			
Sandstone, sharp and nice (Second Cow Run) (Homewood)	60	1690	
Coal, Tionesta	2	1692	
Sandstone	10	1702	
Slate and shells	128	1830	
Sand, (Salt)	60	1890	
Unrecorded	30	1920	
Sand, (Sharon?)	40	1960	330′
Lower Carboniferous (685′)			
Maunch Chunk Series (98′)			
Unrecorded	20	1980	
Sand, Salt? (gas at 1620′; break, 1635′) (Maxton)	78	2058	98′
Greenbrier Limestone (72′)			
Big Lime	72	2130	72′
Pocono Sandstones (515′)			
Big Injun sand, hard (gas)	84	2214	
Unrecorded	206	2420	
Sand, shelly	100	2520	
Unrecorded	110	2630	
Sand, (Berea Grit)	15	2645	515
Devonian (457′)			
Catskill Sandstones (457′)			
Unrecorded	65	2710	
Sand and shells (gas) (Gantz)	10	2720	

	Thickness. Feet.	Feet. Feet.	
Unrecorded	50	2770	
Shells	10	2780	
Unrecorded	10	2790	
Sand, (Thirty-foot)	12	2802	157′
Unrecorded	58	2860	
Shells	5	2865	
Unrecorded	11	2876	
Sand, (Gordon)	12	2888	86′
Unrecorded to bottom of hole	214	3102	214′

The above section is very important in that one or more formations are identified in every series, except the Allegheny, from the middle of the Dunkard of the Upper Carboniferous down to near the base of the Catskill of the Devonian. A marked westward thinning of the Conemaugh series is shown from that of the Long Run section, page 77. The Pittsburgh coal bed is absent from the measures in this region, but its horizon belongs there about 520 feet below the Washington coal and 300 feet below the Uniontown bed. No coals are recorded for the Allegheny series, but they would belong, if present, in the unrecorded interval at the top of the series. The formation at the top of the Pottsville series represents the Second Cow Run sand of Washington county, Ohio, or the Homewood sandstone. The Gordon sand group near the base of the section is represented by only one thin sand that apparently correlates with the true Gordon.

SOUTHWEST DISTRICT.—The following section was measured with aneroid by the writer southeast down the hill road to Hughes river at the mouth of Lower run, three-fourth mile east from the Doddridge-Ritchie county line:

Section One-half Mile East of Summers, Southwest District.

	Thickness. Feet.	Total Feet.	
Upper Carboniferous (290′)			
Dunkard Series (145′)			
Concealed from top of hill	9.7	9.7	
Coal, Washington (4″)	0.3	10	10′
Fire clay shale, Washington	10	20	
Shale, buff	5	25	
Sandstone, coarse, massive, Mannington	55	80	70′
Concealed	30	110	
Red shale	10	120	
Sandstone, massive, Waynesburg	25	145	65′

Monongahela Series (145′)			
Concealed	2	147	
Fire clay shale	3	150	
Concealed and reds	5	155	
Sandstone	5	160	
Red shale with thin sandstones	20	180	
Concealed	20	200	
Sandstone, massive, Uniontown	20	220	
Concealed (contains Uniontown coal horizon)	5	225	80′
Fire clay shale	5	230	
Reds, dark	25	255	
Reds and concealed to forks of road, mouth of Lower run	30	285	
Concealed to Hughes river	5	290	65′

In the above section, the intervals are slightly less than they should be for the reason that the section was measured southeast in descending order along the rise of the strata.

The following section was measured by Mr. Reger near the central portion of Southwest district northward along the hill road to South Fork of Hughes river 1.5 miles below Kelly P. O.:

Section 1.5 Miles West of Kelly P. O., Southwest District.

Upper Carboniferous (355′)	Thickness. Feet.	Total Feet.	
Dunkard Series (150′)			
Sandstone, shaly, Lower Marietta	20	20	
Coal blossom, Washington	0	20	20′
Fire clay, shale, Washington	5	25	
Shale, red	5	30	
Concealed	35	65	
Sandstone, flaggy, Mannington	15	80	60′
Concealed	5	85	
Sandstone, flaggy, Waynesburg	35	120	
Concealed, sandstone and concealed	30	150	70′
Monongahela Series (205′)			
Concealed, sandstone and concealed	15	165	
Sandstone, Gilboy	10	175	
Concealed	35	210	
Sandstone	5	215	
Concealed	20	235	
Sandstone, Uniontown	25	260	110′
Shale, brown	15	275	
Sandstone	5	280	
Concealed	20	300	
Sandstone	10	310	
Fire clay	1	311	
Shale, brown	5	316	
Shale, red	14	330	
Sandstone, Arnoldsburg, to Hughes river	25	355	95′

The section was measured nearly along the strike of the rocks, hence the intervals recorded are approximately correct.

COVE DISTRICT.—This district occupies the extreme southern portion of Doddridge county. The writer measured the following section with aneroid southward from the head of Bear fork along the hill road leading down the latter stream:

Section 1.5 Miles South of Grove P. O., Cove District.

Upper Carboniferous (360') **Dunkard Series (360')**	Thickness. Feet.	Total Feet.	
Sandstone, capping knob, and concealed....	50	50	
Reds and concealed..........................	70	120	
Sandstone, coarse, friable, brown (Hundred?)	20	140	140'
Shale, buff and red..........................	15	155	
Sandstone, massive, Upper Marietta........	40	195	55'
Concealed (with spring water).............	5	200	
Reds, Creston..............................	35	235	
Sandstone, with shale layers, Lower Marietta	15	250	
Shale, sandy................................	5	255	
Concealed	24	279	
Coal (12"), Washington....................	1	280	85'
Fire Clay shale, Washington................	10	290	
Shale, buff..................................	10	300	
Concealed	5	305	
Red shale....................................	10	315	
Sandstone, broken, Mannington............	20	335	55'
Concealed	10	345	
Sandstone, massive, Waynesburg...........	15	360	25'

The section does not reach down to the base of the Dunkard series by 35 to 50 feet. There is some doubt whether the formation 120 feet from the top represents the Hundred sandstone. The latter generally comes 175 to 200 feet above the Washington coal bed. There is no doubt as to the identity of the latter bed.

The following section was obtained in the extreme southeastern corner of Doddridge county by combining a section measured with hand level by the writer westward down the hill road to Big Buck run, one-half mile north of St. Clara P. O., with the log of the Christian Albers No. 1 well (248), published in Vol. I(A) of the State Survey reports, page 298. The latter well is located 1.5 miles southwest of St. Clara P. O.:

Section Near St. Clara P. O., Cove District.

Upper and Lower Carboniferous (2787')	Thickness. Feet.	Total Feet	
Dunkard Series (475')			
Concealed from top of high knob 1 mile N. E. of St. Clara to summit, hill road	160	160	
Shale, red	3	163	
Sandstone, massive, Upper Marietta	31.2	194.2	194.2'
Concealed, mostly red shale	36.4	230.6	
Sandstone	5.2	235.8	
Shale, red, Creston	57.2	293	
Sandstone, massive, Lower Marietta	31.2	324.2	
Concealed	17.8	342	
Coal, blossom, Washington	3	345	150.8'
Fire clay shale, Washington	20.8	365.8	
Sandstone, massive, Mannington	36.4	402.2	
Concealed	6	408.2	
Shale, red, and sandstone	20	428.2	
Concealed	25.8	454	
Shale, red	5	459	
Sandstone, Waynesburg	6	465	
Shale, sandy	5	470	
Concealed	5	475	130'
Monongahela Series (435')			
Concealed	11	486	
Sandstone	2	488	
Concealed to road fork, ½ mile N. E. of St. Clara	3	491	
Interval (barometric measurement) to top of well (248)	95	586	111'
Christian Albers No. 1 Well Log (248).			
Unrecorded	324	910	
Coal, Pittsburgh (thickness not recorded)	..	910	324'
Conemaugh, Allegheny, Pottsville, Mauch Chunk and Greenbrier Limestone (1414')			
Unrecorded	1414	2324	1414'
Pocono Sandstone (463')			
Sand, Big Injun (oil show at 1890')	152	2476	
Unrecorded	281	2757	
Sand, Gantz? (Berea) (oil, 2176'; water 2178')	30	2787	463'
Devonian (6')			
Catskill (6')			
Unrecorded to bottom of well	6	2793	6'

In the above section, the formation at the top was not measured, but estimated from the topographic contour map of the U. S. G. Survey. The formations below the latter down to 491 feet from the top were measured by hand level, and the next determined by an aneroid measurement of the interval from the top of the Albers well (248) up to the crop of the Washington coal bed on a point immediately west from the well.

The oil well drillers in this region have erroneously identified the formation 2757 feet from the top as the Gantz sand. In the writer's judgment, this horizon should correlate with the **Berea Grit**, coming as it does only 433 feet below the top of the Big Injun sand. It is undoubtedly the same formation in which the deep sand oil occurs in the Yellow Creek and Rowles Run fields of Calhoun county on to the southwest.

NEW MILTON DISTRICT.—The following section was obtained in the extreme southeast corner of New Milton district along the Doddridge-Lewis county line by combining a section measured with aneroid by the writer westward along the hill road leading down Spring run of Indian fork, with the log of the D. H. Nicholson No. 1 well (277), published on page 295 of Vol. I(A) of the State Survey reports. Some modifications of the log as originally published are given in parentheses by the writer:

Section One Mile East of Coldwater, New Milton District.

Upper and Lower Carboniferous (2720')	Thickness. Feet.	Total Feet.	
Dunkard Series (467')			
Concealed from summit of high knob to fork of road on ridge	125	125	
Shale, red and sandy	10	135	
Sandstone	5	140	
Shale, red and variegated	20	160	
Fire clay, trace	..	160	
Shale	5	165	
Sandstone, massive, Upper Marietta	40	205	
Concealed	24	229	
Fire clay, Washington "A"	1	230	230'
Concealed and shale	25	255	
Sandstone ....30' Concealed ....30 Sandstone, shaly...10 } **Lower Marietta**	70	325	
Concealed	7	332	
Black slate	2	334	
Coal, Washington	3	337	107'
Fire clay and concealed to top of Nicholson well (277)	23	360	
(D. H. Nicholson No. 1 well record (277)			
Unrecorded	107	467	130'
Monongahela Series (438')			
Unrecorded	433	900	
Coal, Pittsburgh	5	905	438'
Conemaugh and Allegheny Series (915')			
Unrecorded	635	1540	
Sand, Big Dunkard? (Upper Freeport)	75	1615	
Unrecorded	85	1700	

	Thickness. Feet.	Total. Feet.	
Gas (?) sand	5	1705	
Unrecorded	115	1820	915′
Pottsville, Mauch Chunk and Greenbrier Limestone (615′)			
Sand, Salt? (Second Cow Run) (Homewood)	85	1905	
Unrecorded	170	2075	
Sand, Maxton	5	2080	
Unrecorded	355	2435	615′
Pocono Sandstones (285′)			
Big Injun sand	75	2510	
Unrecorded	195	2705	
Sand, Gantz? (Berea)	15	2720	285′
Devonian (546′)			
Catskill Sandstones (546′)			
Unrecorded	298	3018	
Sand, Gordon	7	3025	
Unrecorded	159	3184	
Sand, Fifth (thickness not recorded)	..	....	
Unrecorded to bottom of well	82	3266	546′

* In the above section the top formation is estimated from the topographic contours of the U. S. G. Survey. The base of the Dunkard series is placed at 130 feet below the Washington coal. It may slightly exceed this figure, and in that event the thickness (438′) of the Monongahela series would have to be reduced a like amount. Owing to the lack of details in the well log, it is not possible to separate the Conemaugh and Allegheny series, as well as the Pottsville, Mauch Chunk and Greenbrier Limestone. The formation 2705 feet from the top evidently belongs higher in the measures than at the horizon of the Gantz sand, and probably correlates with the Berea Grit.

GREENBRIER DISTRICT.—The following section was obtained near Miletus in the northern portion of Greenbrier district from the log of the Maxwell Heirs No. 1 well (296), published on page 324 of Vol. I of the State Survey reports. The well starts 10 feet above the crop of the Washington coal bed. The top formation is estimated from the topographic contour map from the summit of a high knob, one-third mile southeast from the well, with allowance made for a dip in the opposite direction of 25 feet:

Section One-half Mile South of Miletus, Greenbrier District.

Carboniferous, Upper and Lower (2875′)	Thickness. Feet.	Total Feet.	
Dunkard Series (555′)			
Unrecorded, concealed mostly from top of of knob southeast of well	415	415	
Maxwell Heirs No. 1 Well Log (296))			
Unrecorded	10	425	
Coal Washington (supplied from crop)	..	425	
Unrecorded	130	555	555′
Monongahela Series (447′)			
Unrecorded	447	1002	
Coal, Pittsburgh (thickness not recorded)	..	1002	447′
Conemaugh, Allegheny, Pottsville, Mauch Chunk and Greenbrier Limestone (1333′)			
Unrecorded	1333	2335	1333′
Pocono Sandstones (540′)			
Sand, Big Injun (gas at 1955′ and 2100′)	185	2520	
Sand, Squaw	150	2670	
Unrecorded	125	2795	
Sand, Gantz? 35′ **Slate** 5 **Sand, Fifty-foot?** 40 } **(Berea)**	80	2875	540′
Devonian (470′)			
Catskill Sandstones (470′)			
Slate	115	2990	
Sand, (gas for boiler) (Thirty foot)	28	3018	
Unrecorded	37	3055	
Shells and shaly sandstone (gas at 2650′) (Gordon Stray)	20	3075	
Shells and slate	10	3085	
Sand, pebbly, Gordon (strong gas)	30	3115	
Shells and slate to bottom of hole	230	3345	470′

The great thickness for the Monongahela series (447′) is unusual for the Doddridge-Harrison area, and in this section it may be due to the fact that the base of the Dunkard series has been placed too high in the measures. The Waynesburg coal horizon is not recorded. The same lack of details in the well record prevents the separation of the Upper and Lower divisions of the Carboniferous system, as well as the different series composing them.

The following section was obtained in the extreme eastern point of Greenbrier district by combining a section from the summit of a high knob, located two miles due north from Big Isaac, with the log of the Geo. T. Richards No. 3 well (315), published on page 294 of Vol. I(A) of the State Survey reports. The top of the well is nearly flush with the Washington coal horizon:

Section One-half Mile North of Big Isaac, Greenbrier District.

	Thickness. Feet.	Total Feet.	
Upper Carboniferous (2060')			
Dunkard Series (330')			
Concealed from top of the knob to well	200	200	
(Log of Richards Well (315))			
Unrecorded	130	330	330'
Monongahela Series (465')			
Unrecorded	460	790	
Coal, Pittsburgh	5	795	465'
Conemaugh Series (525')			
Unrecorded	317	1112	
Sandstone, Little Dunkard? (Saltsburg)	25	1137	
Unrecorded	93	1230	
Sandstone, Big Dunkard (Mahoning)	40	1270	
Unrecorded	50	1320	525'
Allegheny Series (250')			
Unrecorded	250	1570	250'
Pottsville Series (490')			
Unrecorded	130	1700	
Sand, Salt	185	1885	
Unrecorded	175	2060	490'
Lower Carboniferous (700')			
Mauch Chunk Series (110')			
Sand, Maxton	75	2135	
Unrecorded	35	2170	110'
Greenbrier Limestone (65')			
Big Lime	65	2235	65'
Pocono Sandstones (525)			
Sand, Big Injun	100	2335	
Unrecorded	425	2760	525'
Devonian (429')			
Catskill Sandstones (429')			
Unrecorded	8	2768	
Sand, Fifty-foot	25	2793	
Unrecorded	58	2851	
Sand, Gordon Stray (oil, 2664')	35	2886	
Unrecorded	13	2899	
Sand, Gordon	44	2943	
Unrecorded	150	3093	
Sand, Fifth	9	3102	
Unrecorded to bottom of well	87	3189	429'

The lack of detailed records of the wells drilled in this portion of Doddridge county makes it a very difficult matter to correlate the several formations of the rock column, especially so below the top of the Lower Carboniferous.

HARRISON COUNTY SECTIONS.

Several general sections will now be given by districts for Harrison county. There the streams have cut down much deeper into the rock column than in Doddridge, reaching almost to the base of the Conemaugh series.

SARDIS DISTRICT.—Sardis district occupies the northwestern portion of Harrison county. The following section was obtained near the central part of the district at the town of Brown by combining an aneroid section measured by the writer northeastward in part along the hill road to the town, with the log of the I. L. Marsh No. 1 well (373), published on page 250 of Vol. I of the State Survey reports. The well is located at the northwest edge of Brown, and reached a depth of only 1867 feet, hence the lower portion of the section has been supplied from the log of the Temple Smith No. 2107 well (374). The latter well is located only one-half mile northward from the Marsh well. Owing to the rapid dip of the strata in this region to the northwest, it is quite difficult to obtain accurate measurements of the cropping rocks from exposures:

Section at Brown, Sardis District.

Carboniferous, Upper (2007')	Thickness. Feet.	Total Feet.	
Dunkard Series (460')			
Concealed from top of knob to road at low gap southwest of Brown	130	130	
Sandstone, flaggy, green	10	140	
Concealed	4	144	
Shale, red	8	152	
Concealed	25	177	
Sandstone, green, micaceous	10	187	
Shale, variegated and red	15	202	
Concealed	25	227	
Sandstone, green, micaceous, Upper Marietta	10	237	
Shale, red, sandy and variegated, Creston	40	277	
Concealed	25	302	
Sandstone .... 5' Shale, sandy and dark..11 } Lower Marietta.	16	318	
Concealed	5	323	
Coal, Washington, 12" to	2	325	
Fire clay shale, Washington	10	335	335'
Concealed (mostly) to top of Marsh well (373)	90	425	
(I. L. Marsh No. 1 Well Record (373))			
Conductor (surface gravel)	10	435	
Sandstone, white, Waynesburg (Bluff sand).	25	460	125'
Monongahela Series (413')			
Coal, Waynesburg	3	463	
Slate	15	478	
Sandstone, hard and white, (Gilboy) (10" casing, 93')	35	513	
Slate, soft	80	593	

	Thickness. Feet.	Total. Feet.	
Coal, Uniontown	5	598	138′
Limestone, hard, (Uniontown)	30	628	
Slate, soft and white	15	643	
Limestone, hard and blue (Benwood)	112	755	157′
Slate, soft and black	60	815	
Limestone, hard (Sewickley)	15	830	
Slate, white	33	863	
Coal, Pittsburgh	10	873	118′
Conemaugh Series (595′)			
Slate and sandstone (232′?)	222	1095	
Red rock and "cave"	40	1135	
Sandstone, (Grafton)	15	1150	277′
Slate, white, and shells	65	1215	
Sandstone, hard and dark (Saltsburg)	30	1245	95′
Slate and shells, hard and limy (7⅝" casing, 966.5′)	140	1385	
Sandstone, Dunkard (Big Dunkard) (Mahoning) (gas at 970′; blackish oil at 975′)	80	1465	220′
Allegheny Series (300′)			
Slate, black and shells	300	1765	300′
Pottsville Series (242′)			
Sandstone, white (Second Cow Run) (Homewood)	30	1795	
Slate, black	30	1825	
Sandstone, black and close	10	1835	
Sandstone, white and hard	5	1840	
Slate, black	10	1850	
Sand, black........... 55′ Sand, white, solid......102 } (Salt Sand)	157	2007	242′
Lower Carboniferous (681′)			
Mauch Chunk Series (134′)			
Slate and shells	8	2015	
Limestone and slate	10	2025	
Limestone, hard	30	2055	
Red rock	15	2070	
Slate, black and shells	37	2107	
Limestone, hard and blue	6	2113	
Limestone and shells	12	2125	
Red rock	5	2130	
Slate, black, cave, "Pencil"	11	2141	134′
Greenbrier Limestone (49′)			
Limestone, light gray (Big Lime) (5⅝" casing)	49	2190	49′
Pocono Sandstones (498′)			
Sandstone, gray...... 7′ Limestone, gray..... 32 Slate, black........... 4 Limestone, gray......14 Sandstone, white, soft at top (gas at 1833′)...........40 Shale, hard pebbles at bottom, gray..... 5 } **Big Injun sand**	102	2292	

(Temple Smith No. 2107 Well Log (374))

	Thickness. Feet.	Total. Feet.	
Sand, (bottom of Big Injun sand in this well is 1445' below top of Pittsburgh coal)	16	2308	
Unrecorded	380	2688	498'
Devonian (*120'*)			
Catskill Sandstones (120')			
Unrecorded	75	2763	
Sand, Fifty-foot (gas 2' in sand)	44	2807	
Slate to bottom of hole	1	2808	120'

In that portion of the section in which the log of the Marsh well is used, the identifications in parentheses are by the writer. It is a very important section in that many details are given in the different series of the rock column. Also the division plane between the Upper and Lower Carboniferous rocks is sharply defined.

The following section was obtained in the southwest corner of Sardis district by combining the log of the Nathan Goff No. 45 well (362), as furnished the Survey by B. M. Despard of Clarksburg, W. Va., with a section measured with aneroid by D. B. Reger, southward from the summit of a high knob along the road leading down a branch of Grass run:

Section 1.5 Miles South of Fonda P. O., Sardis District.

Upper Carboniferous (*2330'*)	Thickness. Feet.	Total Feet.	
Dunkard Series (822)			
Concealed from summit of high knob to low gap	150	150	
Shale, red, concealed, red shale	25	175	
Sandstone, green, flaggy, micaceous (Nineveh)	20	195	195'
Concealed	50	245	
Sandstone, green, flaggy, fine grained (Burton)	20	265	
Fire clay (Hostetter coal horizon)	1	266	71'
Concealed	44	310	
Sandstone, shaly	5	315	
Concealed	10	325	
Sandstone, shaly	25	350	84'
Shale, red	10	360	
Sandstone, shaly	5	365	
Shale, red	5	370	
Concealed	10	380	
Coal blossom (Fish Creek)	..	380	30'
Concealed to top of Goff well (362)	35	415	
(Nathan Goff No. 45 Well Log (362))			
Unrecorded	274	689	
Coal, Washington	3	692	312'

	Thickness. Feet.	Total. Feet.	
Unrecorded	130	822	130′
Monongahela Series (427′)			
Unrecorded	421	1243	
Coal, Pittsburgh	6	1249	427′
Conemaugh Series (576′)			
Unrecorded	369	1618	
Sandstone, Little Dunkard? (Saltsburg)	33	1651	
Unrecorded	92	1743	
Sandstone, Big Dunkard (Mahoning)	52	1795	
Unrecorded	30	1825	576′
Allegheny Series (265′)			
Unrecorded	170	1995	
Gas sand (Lower Freeport)	20	2015	
Unrecorded	75	2090	265′
Pottsville Series (240′)			
Sand, Salt? (Second Cow Run) (Homewood)	30	2120	
Unrecorded	210	2330	240′
Lower Carboniferous (695′)			
Mauch Chunk Series (125′)			
Unrecorded	60	2390	
Sand, Maxton	25	2415	
Unrecorded	35	2450	
Pencil cave	5	2455	125′
Greenbrier Limestone (72′)			
Big Lime	72	2527	72′
Pocono Sandstones (498′)			
Sand, Big Injun	98	2625	
Unrecorded	400	3025	498′
Devonian (342′)			
Catskill Sandstones (342′)			
Unrecorded	60	3085	
Sand, Fifty-foot	52	3137	
Unrecorded	56	3193	
Sandstone, Thirty-foot	20	3213	
Unrecorded	32	3245	220′
Sand, Gordon Stray	50	3295	
Unrecorded	15	3310	
Sand, Gordon (oil pay, 3222′ light)	30	3340	
Break of slate	3	3343	
Shells	15	3358	
Slate to bottom of hole	9	3367	122′

Note.—Conductor, 14′; 10″ casing, 290′; 8¼″ casing, 1328′; 6⅝″ casing, 2326′; small hole, 2830′; completed, February 6, 1906.

The above section agrees closely with that for Brown, 3½ miles to the northeast. A small coal in addition to the Washington seam occurs in the Dunkard series, 310 feet above the latter bed. It appears to correlate with the Fish Creek vein of the Littleton, Wetzel county, region. In Harrison county this coal is accompanied by 5 to 8 feet of buff and greenish fire clay shale, resembling much in texture and general appearance the Washington fire clay shale. It comes immediately under the bed, and this same feature goes with the Fish Creek coal in eastern Wetzel and western Monongalia counties.

The writer measured the following section with aneroid in the southeastern point of Sardis district from the summit of the high knob, three-fourths mile due west of Katys Lick P. O., eastward to Katys creek. The intervals are much less than they should be for the reason that the section was measured eastward along the rapid rise of the strata. The top of the first formation has risen in that direction at least 75 feet by the time basal formation of the section is reached:

Section Three-fourths Mile West of Katys Lick, Sardis District.

	Thickness. Feet.	Total Feet.	
Dunkard Series (110′)			
Sandstone, buff, micaceous, Mannington, capping knob used as U. S. G. Survey triangulation point	20	20	
Concealed, mostly shale	60	80	
Sandstone, green, micaceous, Waynesburg	15	95	
Concealed	15	110	110′
Monongahela Series (395′)			
Concealed	10	120	
Sandstone, coarse, gray and pebbly, Gilboy	35	155	
Concealed along bench	5	160	
Sandstone, green, micaceous, Uniontown	40	200	90′
Concealed and sandstone, forming steep bluff	70	270	
Concealed	15	285	
Sandstone, shaly and broken, Arnoldsburg	20	305	105′
Concealed	35	340	
Shale, red and sandy	15	355	
Concealed	142	497	
Coal, opening, Pittsburgh (Elev.=1075′B-A. T.)	8	505	200′

TEN MILE DISTRICT.—Ten Mile district lies immediately south of Sardis district, and is bounded on the west by Doddridge county. The following detailed section of the rock column is exhibited by the log of the Robinson No. 1 well (459), published on pages 317-318 of Vol. I(A) of the State Survey reports. The well is located one-half mile due south of the town of Bristol:

Section Two Miles East of Salem, Sardis District.

(Robinson No. 1 Well Log (459))

Upper Carboniferous (1798')	Thickness. Feet.	Total Feet.	
Dunkard Series (312')			
Conductor	10	10	
Red slate	90	100	
Fire clay	4	104	
Soapstone	17	121	
Red shale	18	139	
Red sand	2	141	
Red shale	3	144	
Black shale	6	150	
Washington Coal	2	152	152'
Black shale	8	160	
Blue shale	32	192	
White sand, (Mannington)	31	223	
Blue shale	7	230	
Dark shale	7	237	
Coal, Waynesburg "A"	2	239	87'
Shale, red	11	250	
White sand	12	262	
Red rock	20	282	
Blue shale	30	312	73'
Monongahela Series (414')			
White sand, (Gilboy)	25	337	
Red shale	30	367	
Blue shale	54	421	
Black shale	10	431	
Coal, Uniontown	2	433	121'
Blue shale	23	456	
Red shale	10	466	
Variegated shale	70	536	
Lime, (Benwood)	35	571	
Blue shale	30	601	
Sand, (Sewickley)	25	626	193'
Brown shale	68	694	
Coal (Redstone)	3	697	
Blue shale	19	716	
Pittsburgh coal, top at 720'	6	726	100'
Conemaugh Series (543')			
Blue shale	104	830	
Gray sand, (Connellsville)	15	845	119'
Red shale	43	888	
Blue shale	46	934	
Red rock, (Pittsburgh)	50	984	139'
Blue shale	85	1069	
White sand, Dunkard?, (Saltsburg)	30	1099	
Black shale	35	1134	
Blue shale	135	1269	285'
Allegheny Series (279')			
Lime, (Upper Freeport)	22	1291	
Black slate	77	1368	
Dark sand, (Lower Freeport)	80	1448	179'
Blue slate	40	1488	
Black slate	60	1548	100'

	Thickness. Feet.	Total. Feet.	
Pottsville Series (250')			
Salt sand, brown (Second Cow Run)	115	1663	
Blue slate	35	1698	
Black slate	60	1758	
Lime	40	1798	250'
Lower Carboniferous (707')			
Mauch Chunk (106')			
Slate	7	1805	
Lime	23	1828	
Red rock	40	1868	
Lime	15	1883	
Gray sand	17	1900	
Pencil cave	4	1904	106'
Greenbrier Limestone (132')			
Little Lime and Big Lime (unrecorded)	132	2036	132
Pocono Sandstones (469')			
Big Injun, top, 2036'	174	2200	
Blue slate	70	2270	
Sandy slate	70	2340	
Slate and shells	50	2390	
Blue slate	90	2480	
Brown sand (Berea Grit)	25	2505	469'
Devonian (641')			
Catskill Sandstones (641')			
White slate	83	2588	
White sand, Gantz	15	2603	
Blue slate	9	2612	
White sand	6	2618	
White slate	32	2650	
Blue slate	20	2670	
Hard sand (Fifty-foot)	25	2695	
Sand and shale	40	2735	
Gray sand ("Thirty-foot")	15	2750	
Red sand	25	2775	270'
Slate	13	2778	
Gordon sand (top, 2808')	35	2823	
Blue shale	69	2892	
White sand (Fourth)	6	2898	
Blue shale	104	3002	
Dark sand and shale (Fifth sand)	5	3007	
Shale	25	3032	
Unrecorded to bottom	114	3146	371'

"Some of the measurements as noted in the record do not correspond with the footings as added up in detail, but the discrepancy is slight and probably due to measurements with steel line at important horizons. The 'Little Lime' which belongs just under the Maxton sand, and also the 'Big Lime' which comes on top of the Big Injun sand, a total thickness of 132 feet of measures, have by inadvertancy been dropped from the driller's 'log,' but the omission is corrected by his noting the depth to the top of the Big Injun sand."

The top of the hole has an elevation of 1195 feet above tide (aneroid measurement), while the cropping rocks of the

Dunkard series reach up to an elevation of 1425 feet above tide in the summit of a high knob northeast from the well; hence, to get the true thickness of the latter group of rocks, 230 feet will have to be added to the Dunkard series penetrated by the well boring, giving a total thickness of 542 feet.

The writer has inserted in parentheses correlations and changes in the log as originally published. The section is quite interesting in that two coals in the Dunkard and three in the Monongahela series are recorded, only one of which is probably of minable thickness; viz., the Pittsburgh bed.

The following section was obtained in the southern edge of Ten Mile district by combining the log of the Genius Payne[4] No. 2 well (475) and Genius Payne No. 3 well, published on pages 253-254 of Vol. I of the State Survey reports, with an aneroid section measured by the writer southeast along the hill road leading down Shaw run to the Payne No. 2 well. The latter is located one mile northwest from Deweytown:

Deweytown Section, Ten Mile District.

Upper Carboniferous (*2002'*)	Thickness. Feet.	Total Feet.	
Dunkard Series (415')			
Concealed from summit of knob to road, low gap	100	100	
Shale, red, with thin sandstones	25	125	
Sandstone, shaly, Upper Marietta	44	169	
Fire clay (Washington "A" coal horizon)	1	170	170'
Concealed	20	190	
Shale, red (Creston)	45	235	
Sandstone, coarse, brown and friable, Lower Marietta	25	260	
Shale and concealed	22	282	
Coal, Washington	3	285	115'
Concealed to top of G. Payne No. 2 well (475)	50	335	
(Genius Payne No. 2 Log (475))			
Unrecorded	80	415	130'
Monongahela Series (418')			
Unrecorded	410	825	
(Genius Payne No. 3 Well Log)			
Coal, Pittsburgh	8	833	418'
Conemaugh Series (550')			
Unrecorded	439	1272	
Sandstone, Dunkard? (First Cow Run) (Buffalo)	25	1297	

---

[4] W. Va. Geol. Survey, Vol. 1 (A), page 323; 1904.

	Thickness. Feet.	Total. Feet.	
Unrecorded	55	1352	
Sandstone, Lower Dunkard (Big Dunkard) (Mahoning)	20	1372	
Unrecorded	11	1383	550′
Allegheny Series (260′)			
Unrecorded	260	1643	260′
Pottsville Series (359′)			
Unrecorded	247	1890	
Sand, Salt (Sharon?)	112	2002	359′
Lower Carboniferous (645′)			
Mauch Chunk and Greenbrier Limestone (160′)			
Unrecorded	103	2105	
Red rock	44	2149	
Unrecorded	13	2162	160′
Pocono Sandstones (485′)			
Sand, “Keener” 22′ **“Big Lime”? (part of “Injun”)** 96 **Sand, Big Injun** 47 } **Big Injun**	165	2327	
Unrecorded	195	2522	
Sandstone	25	2547	
Unrecorded	100	2647	485′
Devonian (514′)			
Catskill Sandstone (514′)			
Unrecorded	95	2742	
Sand 10′ **Break** 10 **Sand** 18 } **Fifty-foot**	38	2780	
Unrecorded	142	2922	275′
Sand, Gordon Stray (oil and gas at top)	..	2922	
Unrecorded	43	2965	
Sand, Gordon, Campbells Run	17	2982	
Unrecorded	45	3027	
Fourth sand, Flat Run	..	3027	
Unrecorded	90	3117	195′
Fifth sand, McDonald, dry	4	3121	
Unrecorded to bottom of hole	40	3161	44′

In the above section about 50 feet should be added to the thickness of the Dunkard series for the reason that the first ten formations were measured in descending order southeastward along the rise of the strata. The driller identified the formation at 2184′-2280 feet as the “Big Lime”, but according to I. C. White, in the volume referred to above, pages 254-255, this stratum is a portion of the Big Injun sand which in this region has undergone quite a structural change from sandstone to limy beds. In the section given for Salem, three miles northward from Deweytown, the thickness of the Big Injun sand is recorded as 174 feet. These figures agree closely with those given for the same sand in the Deweytown section.

UNION DISTRICT.—The following hand-level section was measured by D. B. Reger in the extreme northern portion of Union district, Harrison county, from the summit of a high knob on the Union-Ten Mile district line, located 1.5 miles south 15-20 degrees west of Wolf Summit, southeastward to and along the hill road leading down Sycamore:

Section 1.5 Miles South of Wolf Summit, Union District.

	Thickness. Feet.	Total. Feet.	
Upper Carboniferous (450')			
Dunkard Series (76')			
Sandstone, brown, shaly, micaceous, Mannington, capping knob	15	15	
Concealed	11	26	
Shale, brown and red	17	43	
Shale, brown	16	59	
Sandstone, brown, flaggy, micaceous, Waynesburg	17	76	76'
Monongahela Series (348')			
Shale, brown	27	103	
Sandstone, brown, micaceous, Gilboy and Uniontown	66	169	93'
Concealed	23	192	
Shale, red	5	197	
Shale, brown	16	213	
Limestone .... 3'			
Shale, variegated. 4			
Limestone 4			
Shale, limy....... 6			
Limestone 10			
Concealed 11			
Limestone 5			
Shale, brown..... 3			
Shale, brown..... 4			
Limestone, white. 10			
Uniontown and Benwood Limestones	60	273	
Concealed	8	281	
Shale, limy and green	1	282	
Concealed	8	290	
Sandstone, and shale, brown	11	301	
Shale, yellow and brecciated	4	305	
Shale, brown	18	323	
Sandstone, brown, flaggy, fine micaceous, Sewickley	14	337	
Shale, brown	13.8	350.8	
Shale, bituminous (2"), (Sewickley coal horizon)	0.2	351	182'
Concealed	20	371	
Sandstone, shaly	5	376	
Concealed and brown shale	12	388	

	Thickness. Feet.	Total. Feet.	
Shale, dark	5	393	
Coal, Redstone	1	394	
Concealed	22	416	
Coal, Pittsburgh	8	424	73'
Conemaugh Series (26')			
Shale, limy	3	427	
Shale, brown	5	432	
Concealed	11	443	
Sandstone, coarse grained, Lower Pittsburgh	7	450	
Coal, streak, Little Pittsburgh (Base=1115' B-A. T.)	..	450	26'

The section was measured in descending order southeastward along the rise of the strata for a distance of three-fourths mile. The pitch of the rocks at this particular point is about 100 feet to the mile; hence, at least 75 feet will have to be added to the total of the section to get the true height of the rock column. It follows that the intervals represented are shorter than they should be, especially the thickness of the Monongahela series, which should slightly exceed 400 feet in this region.

The following section was obtained along the southeastern border of Union district in the region of West Milford by combining the log of the G. W. Wolf No. 1 well (487), published on page 335 of Vol. I (A) of the State Survey reports, with an aneroid section measured from the summit of a high knob one-half mile north of the town. The Pittsburgh coal bed crops in the hills about 140 feet above the well mouth; hence, the coal 412 feet from the top and 72 feet in depth in the original well record, correlates with the Elk Lick and not with the Pittsburgh bed:

Section One-half Mile North of West Milford, Union District.

	Thickness. Feet.	Total. Feet.	
Upper Carboniferous (1440')			
Monongahela Series (200')			
Concealed from top of high knob	192	192	
Coal, (Pittsburgh)	8	200	200'
Conemaugh Series (590')			
Concealed to top of Wolf well (487)	140	340	
G. W. Wolf No 1 Well Log (487)			
Unrecorded	72	412	
Coal, Pittsburgh? (Elk Lick)	3	415	
Unrecorded	89	504	
Coal, (Harlem)	6	510	310'
Red rock (Pittsburgh) and white sandstone.	30	540	
Lime and white slate	100	640	

	Thickness. Feet.	Total. Feet.	
Sandstone, white (First Cow Run) (Buffalo).	60	700	190′
Slate	40	740	
Sandstone, (Big Dunkard) (Mahoning)	50	790	90′
Allegheny Series (250′)			
Red lime	50	840	
Slate	100	940	
Lime	75	1015	
Coal, (Clarion)	3	1018	
Lime	22	1040	250′
Pottsville Series (400′)			
Slate	125	1165	
Sandstone, white (water at 880′) (Salt)	75	1240	
Slate, black	50	1290	
Sandstone, dark	50	1340	
Sandstone	100	1440	400′
Lower Carboniferous (700′)			
Mauch Chunk (200′)			
Red rock	100	1540	
Sandstone, white (Maxton)	100	1640	200′
Greenbrier Limestone and Pocono Sandstones (500′)			
Lime and sand (Big Lime and Big Injun sand)	200	1840	
Slate	100	1940	
Shells, black	200	2140	500′
Devonian (630′)			
Catskill Sandstones (630′)			
"Sand, Gas"? (Gantz)	30	2170	
Sand, white (gas), (Fifty-foot)	70	2240	
Shells	100	2340	
Sand, (Gordon Stray)	25	2365	
Red rock	75	2440	
Sand, (Fourth)	69	2509	
Slate	131	2640	
Sand, show, Gordon? (Fifth)	..	2640	
Slate	100	2740	
Unrecorded	60	2800	
Sand, Fifth? (Bayard?	..	2800	660′

In the above section the identifications in parentheses are by the writer. The Pottsville and Mauch Chunk measures have begun to thicken up quite rapidly southeastward. The Dunkard series has been entirely eroded and misses the tops of the highest hills in the region of West Milford.

The following section was obtained in the southwest corner of Union district by combining an aneroid section measured by the writer northeast along the hill road, 1 mile north about 80 degrees east of Benson, with the log of the J. M. Hall No. 1 well (522) near by. The record of the latter is published on page 331 of Vol. I(A) of the State Survey reports. The Washington coal is flush with the well mouth, and the Pittsburgh bed is recorded at a depth of 605 feet:

Section One Mile Eastward from Benson, Union District.

	Thickness. Feet.	Total. Feet.	
Upper Carboniferous (1820′)			
Dunkard Series (125′)			
Coal, Washington, summit of hill road	2	2	
Fire clay shale, Washington	13	15	
Sandstone, massive, Mannington	45	60	
Concealed	9	69	
Fire clay (Waynesburg "A" coal horizon)	1	70	70′
Concealed	55	125	
Coal blossom, Waynesburg	..	125	55′
Monongahela Series (485′)			
Concealed	25	150	
Sandstone, broken, Gilboy	10	160	
Shale, red	10	170	
Sandstone, massive, buff, coarse, Uniontown	10	180	
Shale and concealed	65	245	
Coal, Uniontown	1	246	121′
Fire clay and shale, red	9	255	
Sandstone, nodular, limy	6	261	
Shale, sandy and red	9	270	
Concealed to Right fork of Kincheloe creek.	35	305	59′
(J. M. Hall No. 1 Well Log (522))			
Interval	300	605	
Coal, Pittsburgh	5	610	305′
Conemaugh Series (580′)			
Unrecorded	530	1140	
Sandstone, Dunkard (Big Dunkard) (Mahoning)	50	1190	580′
Allegheny Series (220′)			
Unrecorded	115	1305	
Gas sand	4	1309	
Unrecorded	101	1410	220′
Pottsville Series (410′)			
Sandstone, Salt? (Second Cow Run and Salt)	360	1770	
Unrecorded	50	1820	410′
Lower Carboniferous (725)			
Mauch Chunk Series (220′)			
Red rock	150	1970	
Unrecorded	70	2040	220′
Greenbrier Limestone (55′)			
Big Lime	55	2095	55′
Pocono Sandstones (450′)			
Sand, Big Injun	125	2220	
Unrecorded	175	2395	
Sandstone	10	2405	
Unrecorded	140	2545	450′
Devonian (377′)			
Catskill Sandstones (377′)			
Unrecorded	95	2640	
Sand, Stray? (gas, 2670′) (Gantz)	50	2690	
Unrecorded	10	2700	

	Thickness. Feet.	Total. Feet.	
Sand, Gordon? (gas 2715') (Fifty-foot)	40	2740	
Unrecorded	164	2904	
Sand, Fifth (oil), (Gordon)	4	2908	
Unrecorded	14	2922	317'
("Small oil well.")			

The section shows quite an expansion of the Monongahela series. It is barely possible that the coal blossom at 125 feet from the top may represent only a local streak of coal and not the Waynesburg bed. The Washington coal is however correctly identified, and three miles northward at Big Isaac the Washington-Waynesburg coal interval is only 125 to 130 feet. In the Catskill group, the two gas bearing sands appear to lie too close the Big Injun sand, as compared with the section above for West Milford, to correlate with the Stray and Gordon. They come about the right place in the rock column for the Gantz and Fifty-foot, respectively. The much increased interval of the Catskill group below the Pittsburgh coal is due in a large measure to the rapid increase in thickness of the Mauch Chunk and Pottsville measures to the southeast across Harrison county.

The following section was obtained in the southeast portion of Union district by combining the log of the Jacob McConkey[5] No. 1 well (498), located one mile west of the town of Goodhope, with a hand-level section measured by D. B. Reger in descending order along the south hill side at the well:

Section One Mile West From Goodhope, Union District.

	Thickness. Feet.	Total. Feet.	
Upper and Lower Carboniferous (2149')			
Monongahela Series (269')			
Concealed from top of knob (estimated)	150	150	
Sandstone, Sewickley	30	180	180'
Concealed, sandstone and shale	40	220	
Concealed	16	236	
Coal, Redstone (thickness concealed)	..	236	
Concealed	33	269	
Coal, Pittsburgh (thickness concealed)	..	269	89'
Conemaugh Series (591')			
Shale and concealed	80	349	
Sandstone, shaly and concealed (Connellsville)	30	379	

---

[5] Vol. 1 (A), page 334, W. Va. Geol. Survey; 1904.

	Thickness. Feet.	Total. Feet.	
Coal, Little Clarksburg (thickness concealed)	..	379	110′
Limestone, Clarksburg	2	381	
Concealed to McConkey well (498)	14	395	16′
(Jacob McConkey No. 1 Well Log (498))			
Unrecorded	243	638	
Slate, lime and coal (**Bakerstown**)	6	644	249′
Unrecorded	51	695	
Sandstone, Dunkard? (First Cow Run (Buffalo)	80	775	
Unrecorded	85	860	'216
Allegheny, Pottsville and Mauch Chunk (830′)			
Unrecorded	700	1560	
Sand, Maxton (water, 1170′)	115	1675	
Unrecorded	15	1690	830′
Greenbrier Limestone (37′)			
Big Lime	37	1727	37′
Pocono Sandstones (422′)			
Sand, Big Injun	43	1770	
Unrecorded	379	2149	422′
Devonian (406′)			
Catskill Sandstone (406′)			
Sand, Fifty-foot? (Gantz)	46	2195	
Unrecorded	36	2231	
Sand, Stray? (light gas) (Fifty-foot)	..	2231	
Unrecorded	29	2260	
Sand, Gordon? (30-foot)	10	2270	
Unrecorded	113	2383	
Sand, Fourth	42	2425	
Unrecorded	130	2555	
Sand, Fifth (very heavy gas at top) to bottom of hole	..	2555	406′

"Rock pressure, 985 pounds; open gate capacity, 26,000,000 cubic feet.

"Casing, 10", 197 feet; 8¼", 924 feet; 6⅝", 1401 feet."

EAGLE DISTRICT.—The following section was obtained in the northern portion of Eagle district by combining the log of the J. B. Cunningham No. 1 well (363), located on Cunningham run, one mile and a quarter northwest of Peora, with a section measured southwestward from the summit of a high hill to the well. The well was drilled by the Fairmont and Grafton Gas Company about 20 years ago. T. B. Peddicord, Foreman, is authority for log and data.

Section One Mile Southwest of Wyatt, Eagle District.

	Thickness. Feet.	Total. Feet.	
Upper Carboniferous (1610')			
Dunkard and Monongahela Series (440')			
Concealed from top of high hill	432	432	
Coal, Pittsburgh	8	440	440'
Conemaugh Series (570')			
Concealed to Cunningham well (363)	10	450	
(J. B. Cunningham No. 1 Well Log (363))			
Slate and lime	140	590	
Slate	60	650	
Red rock	100	750	
Slate	40	790	
Sandstone, gray, (salt water) (Saltsburg)	50	840	400'
Slate	32	872	
Sandstone (Buffalo and Mahoning)	130	1002	
Slate	8	1010	170'
Allegheny Series (240')			
Slate	128	1138	
Sandstone, white (Gas sand) (Lower Freeport)	78	1216	
Coal, Lower Kittanning	8	1224	214'
Slate	26	1250	26'
Pottsville (360')			
Sandstone, (Second Cow Run) (Homewood)	35	1285	
Slate	40	1325	
Sand, Salt (Connoquenessing)	191	1516	
Slate	4	1520	
Sandstone	20	1540	
Slate	32	1572	
Sandstone	38	1610	360'
Lower Carboniferous (696')			
Mauch Chunk Series (93')			
Red rock	85	1695	
Slate, white	8	1703	93'
Greenbrier Limestone (112')			
Big Lime	112	1815	112'
Pocono Sandstones (491')			
Keener sand	65	1880	
Slate	37	1917	
Sand, "Mannington oil sand", Big Injun	22	1939	
Slate	359	2298	
Sand, Berea	8	2306	491'
Devonian (520')			
Catskill Sandstones (520')			
Slate	44	2350	
Sand, Gantz	18	2368	
Slate	2	2370	
Sand, hard, Fifty-foot	48	2418	
Slate	20	2438	
Sandstone	12	2450	
Sandstone, black, and slate	35	2485	
Red rock	23	2508	
Sand, white, gas (Thirty-foot)	32	2540	
Red rock	70	2610	304'
Sand, gray (Gordon Stray)	13	2623	
Slate	16	2639	

	Thickness. Feet.	Total. Feet.	
Sand, Gordon, big gas	11	2650	
Slate	15	2665	
Sand, gray (Fourth)	13	2678	
Slate to bottom of hole	148	2826	216′

"July 6, 1904, making 300,000 cu. ft. gas from Gordon sand with 450 pounds rock pressure."

The following section was obtained along the eastern boundary of Eagle district at Lumberport by combining a section measured from the top of a high knob southeast from the town with the log of the Caroline Mathews No. 1 well (588). Authority for well log, Horner Gas Supply Company:

Section at Lumberport, Eagle District.

Carboniferous, Upper and Lower (2413)	Thickness. Feet.	Total. Feet.	
Dunkard and Monongahela Series (540′)			
Concealed with limestone, sandstone, etc.	532	532	
Coal, Pittsburgh	8	540	540′
Conemaugh Series (543′)			
Interval (spirit level measurement) to Mathews well	63	603	
Caroline Mathews No. 1 Well Log (588)			
Unrecorded	360	963	
Sandstone, Little Dunkard (First Cow Run) (Buffalo)	20	983	
Unrecorded	40	1023	
Sandstone, Big Dunkard (Mahoning)	60	1083	543′
Allegheny Series (215′)			
Unrecorded	160	1243	
Gas sand (Lower Freeport)	45	1288	
Unrecorded	10	1298	215′
Pottsville and Mauch Chunk (585′)			
Sand, First Salt? (Second Cow Run and Salt) and unrecorded	305	1603	
Sand, Second Salt and unrecorded	245	1848	
Little Lime	20	1868	
Pencil cave	15	1883	585′
Greenbrier Limestone (68′)			
Big Lime	68	1951	68′
Pocono Sandstones (452′)			
Sand, Big Injun (gas, 1354′-1375′)	112	2063	
Unrecorded	340	2403	452′
Devonian (558′)			
Catskill Sandstones (558′)			
Unrecorded	90	2493	
Sand, Fifty-foot	80	2573	
Unrecorded	5	2578	
Sand, Thirty-foot	50	2628	
Unrecorded	115	2743	340′
Sand, Gordon Stray	20	2763	
Unrecorded	10	2773	

	Thickness. Feet.	Total. Feet.	
Sand, Gordon (gas, 500,000 cu. ft. at 2185'; oil, ½ bailer over-night at 2190')	30	2803	
Unrecorded	130	2933	
Sand, Fifth (gas, steel line, 2332½' and 2337'-2358')	28	2961	218'

"10" casing, 152'; 8¼" casing, 918'; 6⅝" casing, 1400'. Gas, 26 tenths water in 6⅝" casing, equivalent to a volume of 2,260,000 cu. ft. daily."

In the above section the thickness of the first formation is estimated from the topographic contours of the U. S. G. Survey. The formation at 1603'-1848' evidently includes much the larger portion of the Mauch Chunk red shales, and for that reason it was not possible to separate the Upper and Lower Carboniferous.

Owing to the lack of details in the several oil and gas well records, it is not always possible to correlate accurately the upper sands of the Catskill measures; viz., Gantz, Fifty-foot, Thirty-foot and Gordon Stray.

CLAY DISTRICT.—Clay district lies in the northeast corner of Harrison county, and most of its area lies east of the West Fork river. The following section was obtained east of the central portion of Clay by combining the log of the W. M. Gray No. 1 well (625), located 1.3 miles southeast from the town of Adamsville and drilled by the Run Smooth Oil and Gas Company, with a section from the summit of a high knob northeast of the well. W. A. Chambers is authority for the record of the well:

Section 1.3 Miles Southeast of Adamsville, Clay District.

	Thickness. Feet.	Total. Feet.	
Upper Carboniferous (1455')			
Monongahela Series (382')			
Concealed from top of high knob	140	140	
(W. M. Gray No. 1 Well Record (625))			
Conductor (13 inch) (surface debris)	12	152	
Unrecorded	78	230	
Coal, "Native" (Sewickley?)	2	232	
Unrecorded	143	375	
Coal, Pittsburgh	7	382	382'
Conemaugh Series (593')			
Unrecorded	198	580	
Sandstone, "Whitehill"? (Murphy) (Morgantown)	70	650	268'
Unrecorded	125	775	
Sandstone, Little Dunkard? (a little gas and oil) (Saltsburg)	50	825	

	Thickness. Feet.	Feet. Feet.	
Unrecorded	90	915	
Sandstone, Big Dunkard (Mahoning)	60	975	325′
Allegheny Series (181′)			
Unrecorded	30	1005	
Sand, "First Gas"? (Burning Springs) (Upper Freeport)	15	1020	
Unrecorded	49	1069	
Coal, Upper Kittanning	7	1076	101′
Sand, "Second Gas" 12′ Unrecorded 15 **Sand, "Third Gas", gas and water, 2′ in** 20 } **(Gas sand) (Lower Freeport)**	47	1123	
Unrecorded	33	1156	80′
Pottsville Series (299′)			
Sand, Salt? (water, 1158′) (Second Cow Run) (Homewood and Upper Connoquenessing)	154	1310	
Coal, (Lower Mercer?)	2	1312	
Sand, Salt (Sharon)	113	1425	
Unrecorded	30	1455	299′
Lower Carboniferous (*716′*)			
Mauch Chunk (350′)			
Red rock	300	1755	
Unrecorded	10	1765	
Little Lime	22	1787	
Unrecorded	3	1790	
Sand. Maxton	13	1803	
Pencil cave	2	1805	350′
Greenbrier Limestone (66′)			
Big Lime	66	1871	66′
Pocono Sandstones (400′)			
Sand, Big Injun, (gas, 1743′; 1763′; 1848′)	126	1997	
Unrecorded	141	2138	
Sand, Berea Grit? (Squaw)	10	2148	
Unrecorded	123	2271	400′
Devonian (*179′*)			
Catskill Sandstones (179′)			
Unrecorded	104	2375	
Sand, Fifty-foot (gas, 2250′, 2260′ and 2266′; oil, 2274′ and 2293′)	75	2450	

"10" casing, 280′; 8¼" casing, 1271′; 6⅝" casing, 1696′. Completed Sept. 13, 1910. Makes 10 bbls. oil and 3,000,000 cu. ft. of gas daily."

The Dunkard series evidently barely misses the top of the high knob, since the thickness of the Monongahela series in this region should not much exceed 425 feet. The Allegheny measures have thinned down to only 181 feet. This feature is quite common to the latter group of rocks in eastern Marion and Taylor counties.

The following section was obtained in the extreme northeastern corner of Harrison county from the log of the R. L. Reed No. 1 well[6] (633), located one-fourth mile southwest of Boothsville. The well mouth is almost flush with the crop of the Elk Lick limestone, and just in the edge of Taylor county:

Section Near Boothsville, Northeast Corner Harrison County.

(R. L. Reed No. 1 Well Log (633))

Upper and Lower Carboniferous (1680′)	Thickness. Feet.	Total. Feet.	
Conemaugh Series (330′)			
Gravel	25	25	
Sandstone, (Grafton)	50	75	75′
Red rock, (Pittsburgh) and lime	125	200	
Sandstone, (First Cow Run) (Buffalo)	50	250	
Black slate	80	330	255′
Allegheny Series (220′)			
Sandstone, (Burning Springs)	70	400	
Slate	35	435	
Coal, (Upper Kittanning)	5	440	110′
Slate and shells	110	550	110′
Pottsville Series and Mauch Chunk (580′)			
Sandstone, (Second Cow Run) (Homewood)	60	610	
Slate	20	630	
Sandstone	20	650	
Slate	25	675	
Sand, (Salt) (Valley Falls) (Upper Connoquenessing)	75	750	200′
Slate and lime	225	975	
Red rock	155	1130	380′
Greenbrier Limestone and Pocono Sandstones (400′)			
Lime, Big	150	1280	
Sand, red Sand } Big Injun	133	1413	
Slate	5	1418	
Sand, squaw	12	1430	
Red rock	10	1440	
Slate	240	1680	550′
Devonian (720′)			
Catskill Sandstones (720′)			
Slate	100	1780	
Sand, Fifty-foot (gas, light, 1798′)	45	1825	
Slate	20	1845	
Sand (Thirty-foot)	30	1875	
Slate and shells	60	1935	255′
Red rock and shells	125	2060	
Slate, black	102	2162	
Sand, red, Fifth	23	2185	250′
Slate, black	12	2197	
Slate and shells	23	2220	

---

[6] W. Va. Geol. Survey, Vol. I (A.), pp. 338-339; 1904.

	Thickness. Feet.	Total. Feet.	
Slate	90	2310	
Slate and shells	20	2330	
Slate to bottom of hole	70	2400	215'

The elevation of the well mouth is 954 feet above tide, spirit level measurement, and the elevation of a summit on the strike of the strata to the south west is about 1220 feet; hence, about 265 feet of the Conemaugh series crops above the well, and the thickness of the latter series as given in the above section should be increased to 590 to 600 feet. Changes in identifications from the log as originally published are given in parentheses.

COAL DISTRICT.—The following section was obtained in the northwestern edge of Coal district by combining the log of the S. E. Hamrick No. 1145 well (657), located 3.5 miles northwest from Clarksburg on the head of Crooked run and drilled by the Hope Natural Gas Company, with a section from the summit of a high knob two-fifths mile north of the well:

Section 3.2 Miles Northeast of Wilsonburg, Coal District.

Upper Carboniferous (1554')	Thickness. Feet.	Total. Feet.	
Monongahela Series (400')			
Concealed from top of high knob	390	390	
(S. E. Hamrick No. 1 Well Log (657))			
Unrecorded	5	395	
Coal, Pittsburgh	5	400	400'
Conemaugh Series (587')			
Unrecorded	407	807	
Sandstone, Little Dunkard (First Cow Run) (Buffalo)	20	827	427'
Unrecorded	160	987	160
Allegheny Series (258')			
Unrecorded	28	1015	
Sand, Big Dunkard? (Burning Springs) (Upper Freeport)	23	1038	
Unrecorded	17	1055	
Gas sand (Lower Freeport)	35	1090	103'
Unrecorded	55	1145	
Sand, First Salt? (water, 810') (Clarion)	65	1210	
Unrecorded	35	1245	155'
Pottsville Series (309')			
Sand, Salt? (Second Cow Run) (Homewood)	45	1290	
Unrecorded	4	1294	

	Thickness. Feet.	Total. Feet.	
Sand, (Salt) (Upper Connoquenessing)	106	1400	
Unrecorded	154	1554	309′
Lower Carboniferous (701′)			
Mauch Chunk (200′)			
Unrecorded	81	1635	
Sand, Maxton	70	1705	
Red rock	7	1712	
Unrecorded	8	1720	
Little Lime	18	1738	
Pencil cave	16	1754	200′
Greenbrier Limestone (55′)			
Big Lime	55	1809	55′
Pocono Sandstones (446′)			
Sand, Big Injun	111	1920	
Unrecorded	30	1950	
Sand, Squaw	30	1980	
Unrecorded	260	2240	
Sand, Gantz (Berea Grit)	15	2255	446′
Devonian (562)			
Catskill Sandstones (562′)			
Unrecorded	85	2340	
Sand, Fifty-foot	50	2390	
Unrecorded	15	2405	
Sand, Thirty-foot	52	2457	
Unrecorded	23	2480	
Red rock	37	2517	
Unrecorded	92	2609	354′
Sand, Gordon Stray?..... 8′ Sand, Gordon? (oil, 2231′).20 Unrecorded .... 1 Sand, Fourth.............45 } (Fourth)	74	2683	74′
Unrecorded	5	2688	
Sand (probably local)	27	2715	
Slate, white	51	2766	
Sand, Fifth (gas, 2377′; 2386′ and 2398′)	27	2793	
Unrecorded to bottom of hole	24	2817	134′

The following section was obtained in the northeast corner of Coal district on Jack run, two miles north of Clarksburg, by combining the log of the Robert W. Coon No. 1 well (665), published on pages 328-329, Vol. I(A) of the State Survey reports, with an aneroid section measured by D. B. Reger northeast from the summit of a high knob one mile southeast from the well, mostly along a public highway:

Section Two Miles North of Clarksburg, Coal District.

Upper Carboniferous (1520')	Thickness. Feet.	Total. Feet.	
Monongahela Series (365')			
Sandstone, flaggy, capping hill	30	30	
Concealed	30	60	
Sandstone	5	65	
Concealed	23	88	
Limestone	12	100	100'
Concealed	5	105	
Sandstone, shaly	10	115	
Shale, red	15	130	
Concealed	10	140	
Sandstone, shaly	5	145	45'
Limestone, silicious 20' Shale, limy 10 Lime, silicious 10 Shale and sandstone, shaly 15 Limestone 2 Shale, limy 8 Limestone 5 **Benwood Limestone**	70	215	
Sandstone, flaggy (Sewickley)	25	240	
Shale, brown	7	247	
Coal, Sewickley	3	250	105'
Shale, sandy	10	260	
Sandstone	5	265	
Shale, brown	20	285	
Fire clay, streak	0	285	
Shale, brown	5	290	
Sandstone, shaly	5	295	
Concealed, sandstone and shale	39	334	
Coal, Redstone	1	335	85'
Shale, limy	10	345	
Concealed	12	357	
Coal, Pittsburgh	8	365	30'
Conemaugh Series (550')			
Interval to top of Robert W. Coon well (665).	35	400	
Robert W. Coon No. 1 Well Log (665))			
Unrecorded	20	420	
Limestone?	74	494	
Coal, (Little Clarksburg)	2	496	131'
Slate	19	515	
Limestone?	91	606	
Slate	7	613	
Coal, Elk Lick	6	619	123'
Slate	61	680	
Lime	60	740	
Sandstone, (Saltsburg)	35	775	
Lime	15	790	
Coal, Bakerstown	6	796	177'
Sandstone, Little Dunkard (First Cow Run) (Buffalo) (water and black oil at 410')	84	880	
Slate	35	915	119'
Allegheny Series (233')			
Coal, Upper Freeport	3	918	
Slate	27	945	

	Thickness. Feet.	Total. Feet.	
Sandstone, (Upper and Lower Freeport)....	145	1090	
Slate	20	1110	195′
Coal, Kittanning (Clarion).................	2	1112	
Slate	36	1148	38′
Pottsville Series (372′)			
Sand, Salt? (Second Cow Run) (Homewood) water, 786′ and 805′)....................	87	1235	
Slate	12	1247	
Lime	13	1260	
Sand, Salt (water, 870′) (Upper Connoquenessing)	80	1340	
Slate	40	1380	
Lime	35	1415	
Sand, Maxton? (Sharon).....................	75	1490	
Lime	30	1520	372′
Lower Carboniferous (*700′*)			
Mauch Chunk (285′).........................			
Slate	45	1565	
Red rock..................................	195	1760	
Slate	35	1795	
Pencil cave...............................	10	1805	285′
Greenbrier Limestone (55′)			
Big Lime..................................	55	1860	55′
Pocono Sandstones (360′)			
Sand, Big Injun...........................	110	1970	
Slate	12	1982	
Lime shells...............................	10	1992	
Red rock..................................	5	1997	
Lime	53	2050	
Slate	40	2090	
Sandstone	18	2108	
Lime	32	2140	
Slate	70	2210	
Sand, Gantz? (Berea Grit)..................	10	2220	360′
Devonian (*703′*)			
Catskill Sandstones (703′)			
Lime shells...............................	60	2280	
Slate	35	2315	
Sand, Fifty-foot..........................	55	2370	
Slate	15	2385	
Sand, Thirty-foot.........................	85	2470	
Red rock..................................	3	2473	
Sand, Gordon Stray........................	37	2510	
Slate	5	2515	295′
Sand, Gordon..............................	45	2560	
Red rock..................................	20	2580	
Lime shells...............................	30	2610	
Red rock, slate and shells................	90	2700	
Sand, Fourth..............................	20	2720	
Slate	35	2755	240′
Sand, Fifth (gas, 2360′)..................	15	2770	
Slate and shell...........................	60	2830	
Sand, (Bayard) (gas, small, 2435′; oil, 2 bbls., 2462′)	40	2870	
Unrecorded to bottom of hole..............	53	2923	168′

"Casing record—10″ casing, 196′; 8″ casing, 940′; 6⅝″ casing, 1575′ ".

The above is probably the most interesting section yet given for the Doddridge-Harrison area. The upper 400 feet of the section was measured from crop, and gives three well-known coal beds of the Monongahela series: viz., Sewickley, Redstone and Pittsburgh. The section lacks 30 to 50 feet of reaching up to the base of the Dunkard series, the latter having been eroded from this immediate region. The well log also contains five well known coals of the Conemaugh and Allegheny series; viz., Little Clarksburg, Elk Lick, and Bakerstown of the Conemaugh, and Upper Freeport and Clarion of the Allegheny. The only doubt as to the correlation of these different coal beds exists with the one called the Clarion. Northeastward in Taylor county, the Lower Kittanning coal crops only 150 to 160 feet below the Upper Freeport coal, and for that reason the interval (195 feet) appears too large for this coal at 1110 feet from the top to come in the Kittanning group of coals.

The correlation of the different sands of the Catskill series in the section presents quite a problem, since red rock occurs at two different points at the horizon of the Gordon group of sands. It is barely possible that the sand at 2700'-2720' may be the true Gordon Stray as evidenced by the overlying reds, and in that event the ones struck at 2755' and 2830' from the top of the section become the Gordon and Fourth sands respectively. The Pittsburgh coal-Gordon sand interval then would be 2465 feet as opposed to 2087 feet at Burton, Wetzel county. The increased thickness of the intervening Pottsville, Mauch Chunk and Pocono beds in the Clarksburg region over that at Burton[7] would easily make up the difference in interval between the two points.

CLARK DISTRICT.—The following section was obtained along the northern boundary line of Clark district, Harrison county, by combining the log of the Hattie Porter No. 1 well (670)—drilled by the Peerless Carbon Black Company and located on Simpson fork of Limestone run, one mile south of Wilsonburg—with an aneroid section, measured by the writer from the summit of a high knob northward to the well mouth:

---

[7] See Burton Section, Marshall-Wetzel-Tyler Report, pp. 110-113, W. Va. Geological Survey; 1909.

Section One Mile South of Wilsonburg, Clark District.

	Thickness. Feet.	Total. Feet.	
Upper Carboniferous (1205′)			
Monongahela Series (75′)			
Concealed from top of knob	35	35	
Redstone coal horizon	..	35	
Concealed to foot of steep slope	32	67	
Coal, Pittsburgh (old opening)	8	75	75′
Conemaugh Series (554′)			
Fire clay, concealed, and shale	39	114	
Coal, Little Pittsburgh, 8″ to	1	115	
Shale and concealed	45	160	
Shale	5	165	
Sandstone, massive, coarse, brown and pebbly, (Connellsville)	30	195	
Concealed	5	200	
Coal blossom, Clarksburg	0	200	125′
Concealed to well mouth of Porter No. 1 (670)	35	235	
Hattie Porter No. 1 Well Log (670))			
Conductor (surface gravel)	10	245	
Red rock (Clarksburg)	20	265	
Lime	10	275	
Slate, black	30	305	
Lime	15	320	
Lime, red	20	340	
Slate, white	30	370	
Lime (10″ casing, 140′)	5	375	
Slate and shells	10	385	
Unrecorded	60	445	
Coal, Bakerstown	4	449	249′
Sandstone, Little Dunkard (First Cow Run) (Buffalo)	90	539	
Slate	50	589	
Sandstone, Big Dunkard (Mahoning)	40	629	180′
Allegheny Series (236′)			
Sandstone (show of oil and water), Big Dunkard? (Burning Springs) (Upper Freeport)	100	729	
Slate, black (8″ casing, 594′)	80	809	
Slate, black	50	859	
Coal, (Clarion)	6	865	236′
Pottsville Series (340′)			
Sand, Salt? (Second Cow Run) (Homewood)	70	935	
Slate	50	985	
Sand, (gas sufficient to run boiler) Salt (Connoquenessing)	210	1195	
Slate, black	10	1205	340′
Lower Carboniferous (755′)			
Mauch Chunk (210′)			
Slate and shells	30	1235	
Sand, white, Maxton? (gas and 15 bailers water) (Sharon)	30	1265	

	Thickness. Feet.	Total. Feet.	
Lime, Little?	20	1285	
Slate, black	20	1305	
Red rock	18	1323	
Sand, Keener? (Maxton)	22	1345	
Lime (Little)	40	1385	
Red rock	30	1415	210′
Greenbrier Limestone (60′)			
Big Lime (6″ casing, 1250′)	60	1475	60′
Pocono Sandstones (485′)			
Sand, Big Injun (gas, sufficient for boiler at 1370′; gas at bottom, 1400′)	160	1635	
Slate and shells	40	1675	
Sand, Squaw	100	1775	
Slate and shells	150	1925	
Sand, Berea	35	1960	485′
Devonian (504′)			
Catskill Sandstones (504′)			
Slate and shells	35	1995	
Sand, Gantz	35	2030	
Slate	20	2050	
Sand, pebbly, Fifty-foot	25	2075	
Slate and shells	15	2090	
Sand, Thirty-foot	25	2115	
Slate, white	18	2133	
Slate and shells, red	45	2178	
Bastard sand	15	2193	
Slate, white	15	2208	
Brown rock and shells	40	2248	
Slate, white	25	2273	313′
Sand, good gas, 10½′ in sand (Gordon Stray)	38	2311	
Slate	10	2321	
Sand, (Gordon)	2	2323	
Slate, black	32	2355	
Sand, gray (Fourth)	12	2367	
Slate, black	64	2431	
Sand, Fifth	20	2451	
Slate to bottom	13	2464	191′

The section is quite interesting, in that complete details are given of the Catskill measures, as well as of the Mauch Chunk and Pottsville.

The following section was measured with aneroid from the summit of a high knob by D. B. Reger northward to Limestone run at Adamston:

Section at Adamston, Clark District.

	Thickness. Feet.	Total. Feet.	
Monongahela Series (325')			
Shale, brown, capping knob	25	25	
Sandstone	5	30	
Concealed	260	290	
Coal, Redstone (thickness concealed)	..	290	
Concealed	27	317	
Coal, Pittsburgh	8	325	325'
Conemaugh Series (150')			
Concealed and limestone, Clarksburg, to Limestone run	150	475	150'

The following section was obtained 2 miles south 30 degrees east from Clarksburg from the log of a well (676) drilled on the John Cost farm by the Graselli Chemical Company. The latter is authority for the well record. The well mouth is about 200 feet below the level of the horizon of the Pittsburgh coal bed:

Section 1.5 Miles Northwest of Quiet Dell, Clark District.

	Thickness. Feet.	Total. Feet.	
Upper Carboniferous (1000')			
Conemaugh and Allegheny (550')			
Conductor	14	14	
Sand, (Grafton)	56	70	
Slate	55	125	
Rock (red)	35	160	
Slate	45	205	
Sand, (First Cow Run) (Buffalo)	35	240	240'
Slate	110	350	
Sand	10	360	
Slate	90	450	
Sand, (Lower Freeport)	25	475	235'
Slate	10	485	
Lime	65	550	75.
Pottsville Series (450')			
Sand, (Second Cow Run) (Homewood)	85	635	
Lime	37	672	
Coal, Upper Mercer	5	677	127'
Sand	25	702	
Lime	28	730	
Salt Sand	135	865	
Lime	35	900	
Slate	100	1000	323'
Lower Carboniferous (795')			
Mauch Chunk (285')			
Red rock	20	1020	
Lime	50	1070	
Red rock	30	1100	
Lime	50	1150	
Red rock	85	1235	

	Thickness. Feet.	Total. Feet.	
Slate	15	1250	
Little Lime	15	1265	
Pencil cave	20	1285	285'
Greenbrier Limestone (65')			
Big Lime	65	1350	65'
Pocono Sandstones (445')			
Big Injun sand	110	1460	
Red rock	20	1480	
Limestone shells	90	1570	
Sand and shells (Squaw)	20	1590	
Slate and shells	180	1770	
Sand, (Berea)	25	1795	445'
Devonian (530')			
Catskill Sandstones (530')			
Sand and shells	120	1915	
Sand, (Fifty-foot)	25	1940	
Sand and shells	40	1980	
Sand, Gordon? (Thirty-foot)	25	2005	
Red rock	155	2160	
Sand, (Gordon)	30	2190	
Red rock	10	2200	
Sand, (Fourth?)	45	2245	
Slate	41	2286	
Sand, Fifth?	30	2316	
Slate	9	2325	530'

In the section it was not possible to show the dividing line with any degree of accuracy between the Conemaugh and Allegheny series. A streak of red occurs at the base of the top member of the Pocono measures, an unusual feature in this portion of the State. In fact, a very large portion of the Lower Carboniferous rocks in this particular section are red beds. It is barely possible that the Pocono has thinned down to the thickness (110') given for the Big Injun, and if so, the Catskill measures would begin at 1460'. The sandstones in the latter series would then require re-naming.

SIMPSON DISTRICT.—The following section was obtained in the north central portion of Simpson district, Harrison county, by combining the log of the J. R. Stout No. 1 well (685), located 1.2 miles due north of Bridgeport and drilled by the Bridgeport Natural Gas & Oil Company, D. H. Gawthrop, Manager, and authority for well record, with an aneroid section measured by the writer from the summit of the hill directly northwest of the well. The top of the hill is 40 to 50 feet below the horizon of the Pittsburgh coal:

Section 1.2 Miles North of Bridgeport, Simpson District.

	Thickness. Feet.	Total. Feet.	
Upper Carboniferous (1050′)			
Conemaugh Series (562′)			
Concealed from top of hill	70	70	
Shale, buff	5	75	
Coal, Little Clarksburg	2	77	77′
Fire clay	5	82	
Concealed to J. R. Stout No. 1 well (685)	30	112	
(J. R. Stout No. 1 Well Log (685))			
Conductor (top, 1160′ B A. T.)	13	125	
Unrecorded	152	277	
Coal, (Harlem)	3	280	203′
Unrecorded	142	422	
Sandstone, Little Dunkard (First Cow Run) (Buffalo)	25	447	
Unrecorded	70	517	
Sandstone, Big Dunkard (Mahoning)	45	562	282′
Allegheny Series (215′)			
Unrecorded	20	582	
Sand, "First Gas?" (Burning Springs) (Upper Freeport)	50	632	
Unrecorded	70	702	
Sand, "Second Gas"? ("Gas") (Lower Freeport)	50	752	
Unrecorded	25	777	215′
Pottsville Series (273′)			
Sand, "Third Gas"? (Second Cow Run) (Homewood)	130	907	
Unrecorded and Salt sand	143	1050	273′
Lower Carboniferous (797′)			
Mauch Chunk (362′)			
Red rock	142	1192	
Lime, grit, sandstone	45	1237	
Red rock	95	1332	
Lime	30	1362	
Red rock	50	1412	362′
Greenbrier Limestone (85′)			
Big Lime	85	1497	85′
Pocono Sandstones (360′)			
Sand, Big Injun	120	1617	
Unrecorded	230	1847	350′
Devonian (740′)			
Catskill Sandstones (740′)			
Unrecorded	55	1902	
Sand, Fifty-foot (little gas, 1930′-1987′)	..	....	
Unrecorded	200	2102	
Sand, Thirty-foot	22	2124	
Unrecorded	10	2134	
Sand, Gordon Stray	50	2184	
Unrecorded	5	2189	
Red rock	10	2199	352′
Sand, (Gordon)	8	2207	
Red rock	121	2328	
Shell	2	2330	

	Thickness. Feet.	Total. Feet.	
Red rock	32	2362	
Sand, (Fourth)	10	2372	
Unrecorded	3	2375	
Slate	7	2382	
Sand, white (Fifth)	10	2392	
Unrecorded and black slate	76	2468	
Sand (light gas, 2432')	86	2554	
Unrecorded to bottom of hole	33	2587	388'

In the above section the identifications in parentheses are by the writer. The Mauch Chunk measures are 77 feet thicker than on Jack run, 4 miles to the northwest, as given in the preceding section.

The following section was obtained in the extreme southern part of Simpson district, Harrison county, by combining the log of the Coplin Heirs No. 1 well (698A), drilled by the Tri-State Gas Company (authority for record) and located on Brushy fork of Elk creek, one-half mile southeast from Grassland P. O., with a section measured from the summit of a high knob, 0.7 mile southwest of the well.

Section One-half Mile Southeast of Grassland, Simpson District.

Upper Carboniferous (1710')	Thickness. Feet.	Total. Feet.	
Monongahela Series (295')			
Concealed from top of knob	265	265	
Coal, Redstone	6	271	
Concealed	4	275	
Limestone, Redstone	3	278	
Shale, limy	11	289	
Coal, Pittsburgh	5	295	295'
Conemaugh Series (565')			
Concealed	134	429	
Coal, Little Clarksburg	1	430	135'
Limestone .... 1' Shale, limy....... 5 Limestone .... 2 } Clarksburg	8	438	
Concealed to top of Coplin Heirs Well (698A)	32	470	
(Coplin Heirs No. 1 Well Log (698A))			
Unrecorded	150	620	
Coal, (Harlem)	4	624	194'
Unrecorded	178	802	
Coal (Brush Creek)	2	804	180'
Unrecorded	21	825	
Sandstone, Little Dunkard? (Big Dunkard) (Mahoning)	30	855	
Unrecorded	5	860	56'

	Thickness. Feet.	Total. Feet.	
Allegheny Series (220')			
Unrecorded	60	920	
Sandstone, Big Dunkard? ("Gas"), (Lower Freeport)	60	980	
Unrecorded	100	1080	220'
Pottsville Series (630')			
Sand "Gas"? (Second Cow Run) and Salt (no break)	630	1710	630'
Lower Carboniferous (484')			
Mauch Chunk (48')			
Lime	10	1720	
Red Rock and slate	15	1735	
Lime	8	1743	
Slate	10	1753	
Red Rock	5	1758	48'
Greenbrier Limestone (77')			
Big Lime	77	1835	77'
Pocono Sandstone (359')			
Sand, Big Injun	105	1940	
Slate and lime shells	230	2170	
Unrecorded	11	2181	
Sand, Gantz? (Berea)	13	2194	359'
Devonian (2304')			
Catskill Sandstones (686')			
Slate	21	2215	
Sand, (Gantz and Fifty-foot)	137	2352	
Slate and shells	118	2470	
Red rock	245	2715	
Unrecorded	2	2717	
Sand, Fifth, broken	32	2749	555'
Red rock	31	2780	
Slate and shells	100	2880	131'
Chemung and Portage (1618')			
Slate and shells	340	3220	
Slate, white	70	3290	
Slate and shells	130	3420	
Lime and shells (little gas at top)	370	3790	910'
Lime, with occasional break of slate	130	3920	130'
Slate and shells to bottom	578	4498	578'

"Changed to wire line at depth of 2530 feet from top of hole."

The section is of much interest in that it goes deeper into the stratified rocks than any yet published for the Doddridge-Harrison area. If to the section we add the top portion (100 feet) of the Monongahela series, and 1160 feet for the total thickness of the Dunkard measures as shown by the Alliance section in the northwestern corner of Harrison county, then we obtain a total, exposed at crop, and penetrated by oil and gas well borings, of 5784 feet.

The limestone at 3790' may possibly correlate with the Tully limestone at the base of the Upper Devonian as the latter is classified by Clark and Schuchert[8]. If so, the basal 578 feet would then represent the Hamilton shales, only a few hundred feet above the Corniferous limestone.

Several errors in correlation of the sandstone beds of the Conemaugh and Allegheny series were made by the drillers, but the writer has inserted in parentheses the true names. The Pottsville series, as given in this record is entirely too thick (630'), and this interval doubtless contains several members, and also includes about 300 feet of the Mauch Chunk, the Maxton sand coming at its base.

GRANT DISTRICT.—The following section was obtained in the northern portion of Grant district by combining a hand level section measured by D. B. Reger along the hill road northwest of Byron, with the log of the Claude Davisson No. 1 well (701), located on Browns creek, one-fourth mile northwest of the town, and drilled by the Weston Gas Company. T. Moore Jackson of Clarksburg, W. Va., is authority for the well record:

Section One-fourth Mile Northwest of Byron, Grant District.

Upper and Lower Carboniferous (2297')	Thickness. Feet.	Total. Feet.	
Monongahela Series (317')			
Concealed from top of knob on Grant-Union district line	20	20	
Sand, hard, flaggy, micaceous, Uniontown	11	31	
Concealed	38	69	
Sandstone, brown, flaggy 17' Shale, red 14 Sandstone, shaly 7 (Arnoldsburg Sandstone)	38	107	107'
Shale, brown	27	134	
Shale, red	10	144	
Sandstone, brown, micaceous, flaggy	15	159	
Concealed	10	169	
Limestone, concealed, and Limestone Benwood	12	181	
Sandstone, shaly	16	197	
Concealed	6	203	
Sandstone, brown, shaly, micaceous	2	205	
Shale, brown	3	208	
Shale, bituminous (1") (Sewickley coal horizon)	0	208	101'
Shale, brown	7	215	

---

[8] Science, Vol. X; 1899.

	Thickness. Feet.	Total. Feet.	
Sandstone, brown, shaly, Lower Sewickley..	20	235	
Concealed	55	290	
Coal, Redstone	1	291	83′
Concealed	18	309	
Coal, Pittsburgh	8	317	26′
Conemaugh Series (547′)			
Sandstone, soft, Lower Pittsburgh	11	328	
Concealed	13	341	
Coal streak, Little Pittsburgh	0	341	
Concealed	14	355	
Shale, sandy	11	366	
Concealed	33	399	
Sandstone, Connellsville, to level of Davisson well (701)	25	424	
(Claude Davisson No. 1 Well Log (701))			
Conductor (surface gravel)	10	434	
Shale (water 5′ below top)	75	509	
Sandstone, (Morgantown)	40	549	232′
Slate	20	569	
Sandstone, (Grafton)	25	594	
Slate	20	614	
Coal, (Harlem)	5	619	70′
Slate	15	634	
Sandstone, (Saltsburg)	40	674	
Sandstone shells	190	864	245′
Allegheny Series (220′)			
Sandstone, (Big Dunkard)	60	924	
Slate	90	1014	
Sandstone, (Clarion)	50	1064	
Slate	20	1084	220′
Pottsville Series and Mauch Chunk (708′)			
Sandstone, (Homewood)	60	1144	
Slate	30	1174	
Sandstone (Upper and Lower Connoquenessing)	160	1334	
Slate, black	220	1554	
Red rock	200	1754	
Slate	38	1792	708′
Greenbrier Limestone (94′)			
Big Lime (steel line measurement)	94	1886	94′
Pocono Sandstones (411′)			
Sand, Keener	12	1898	
Sand, red	11	1909	
Sand, white, Big Injun	73	1982	
Slate	282	2264	
Sand, (Berea)	33	2297	411′
Devonian (527′)			
Catskill Sandstones (527′)			
Slate and shells	17	2314	
Sand, (Gantz and Fifty-foot)	185	2499	
Red slate and shells	10	2509	
Sand, (Thirty-foot)	15	2524	
Slate	20	2544	
Red slate	50	2594	297′
Red and gray sand shells	40	2634	

	Thickness. Feet.	Total. Feet.	
Red slate	40	2674	
Slate, white	10	2684	
Sand, Fourth	35	2719	
Slate, blue	27	2746	
Sandstone, brown, with white pebbles (large flow of gas at top; steel line measurement) (Fifth)	18	2764	
Slate, white, to bottom	60	2824	230'

The following section was obtained from the log of the C. S. Gribble No. 1 well (708A), located in the southeastern edge of Grant district, Harrison county, on a branch of Lost creek, one mile south 80° east from Lost Creek station. The record of the well was furnished by the owners, the Lost Creek Oil & Gas Company, through G. M. Gribble. Changes and modifications of the correlation of the different formations by the writer are indicated in parentheses. The well mouth is 15 to 20 feet above the Harlem coal and about 300 feet below the Pittsburgh coal bed:

Section One Mile Southeast of Lost Creek, Grant District.

(C. S. Gribble No. 1 Well (708A) Log.)

Upper Carboniferous (920')	Thickness.	Total.	
Conemaugh Series (330')	Feet.	Feet.	
Unrecorded	20	20	
Sand	20	40	
Red rock	15	55	
Lime and shells	20	75	
Slate	10	85	
Lime	15	100	
Red rock	15	115	
Lime, shelly	17	132	
Coal, Bakerstown	3	135	135'
Lime	15	150	
Slate	10	160	
Lime	40	200	
Slate	12	212	
Lime shells and slate	38	250	
Red rock	5	255	
Lime shells and slate	45	300	
Lime	30	330	195'
Allegheny Series (225')			
Lime	50	380	
Sandstone, Big Dunkard? ("Gas") (Lower Freeport)	50	430	
Coal, Mapletown? (Upper Kittanning)	5	435	105'

			Thickness. Feet.	Total. Feet.	
Black slate			30	465	
Lime			80	545	
Black slate			10	555	120′
Pottsville Series (365′)					
Sand	15′	(Homewood)	55	610	
Slate	7				
Sand	33				
Slate			5	615	
Sand (water, 650′-655′) (Upper Connoquenessing)			58	673	
Slate			7	680	
Lime			30	710	
Slate, shells and lime			82	792	
Sand, (Salt)			128	920	365′
Lower Carboniferous (697′)					
Mauch Chunk (270′)					
Lime			20	940	
Red rock			35	975	
Lime			15	990	
Sandy lime			35	1025	
Red rock, lime, and shells			120	1145	
Lime			30	1175	
Pencil cave			15	1190	270′
Greenbrier Limestone (60′)					
Big Lime			60	1250	60′
Pocono Sandstones (367′)					
Big Injun sand			115	1365	
Slate, lime and shells			35	1400	
Lime			35	1435	
Slate			25	1460	
Lime			30	1490	
Slate, lime and shells			35	1525	
Lime			15	1540	
Slate			10	1550	
Black lime and slate			37	1587	
Sand, Gantz? (Berea) (gas, 1,000,000 feet)			30	1617	367′
Devonian (540′)					
Catskill Sandstones (540′)					
Slate and break			14	1631	
Sand, white, pebbly (Gantz)			32	1663	
Black slate			17	1680	
Slate			27	1707	
Sand, Fifty-foot	18′	(Fifty-foot)	30	1737	
Break	2				
Sand	10				
Lime			10	1747	
Black slate			3	1750	
Thirty-foot sand	35′	(Thirty-foot)	80	1830	
Slate and shells	25				
Hard sand	20				
Lime shells			10	1840	
Red rock and lime			60	1900	
Red rock			10	1910	
Lime			5	1915	298′
Sand, Gordon			5	1920	

	Thickness. Feet.	Total. Feet.	
Red rock and shells	25	1945	
Lime	15	1960	
Slate and shells	10	1970	
Hard, sandy lime	25	1995	
Lime	20	2015	
Fourth sand (gas, 2,000,000 feet)	20	2035	
Slate	15	2050	
Slate, lime and shells	50	2100	
Slate	22	2122	
Fifth sand (gas, 2,500,000 feet)	28	2150	
Slate to bottom	7	2157	242′

"Completed July 30, 1910."

ELK DISTRICT.—Elk district occupies the southeastern corner of Harrison county. The following section was obtained on Stevens run of Elk creek near the central portion of Elk district and one mile northwest from Romines Mills, by combining a section measured with aneroid by D. B. Reger from the summit of a high knob one mile due south of Craigmoor P. O., with the log of the A. H. Davisson No. 1 gas well (737), drilled by the Tri-State Gas Company, which is also authority for the record of the well:

Section One Mile Northwest of Romines Mills, Elk District.

Upper Carboniferous (1295′)	Thickness. Feet.	Total. Feet.	
Monongehela Series (60′)			
Concealed from top of knob	30	30	
Sandstone	5	35	
Coal, (Redstone) (mine in, but abandoned and thickness concealed)	5	40	
Concealed	14	54	
Coal (visible 12″), Pittsburgh (thickness concealed)	(6)	60	60′
Conemaugh Series (610′)			
Concealed	115	175	
Sandstone, gray, with iron oxide specks (Connellsville)	20	195	135′
Concealed	85	280	
Sandstone, concealed and sandstone	65	345	
Shale and concealed	35	380	
Shale, green, fossiliferous (Ames)	20	400	
Limestone, fossiliferous, (Lower Ames)	1	401	
Coal, Harlem	2	403	208′
Limestone, good, Ewing	4	407	
Shale, red and limy (Pittsburgh)	33	440	
Concealed to A. H. Davisson No. 1 well (737)	15	455	
(A. H. Davisson No. 1 Well Log (737))			
Unrecorded	140	595	

	Thickness. Feet.	Total. Feet.	
Sandstone, Little Dunkard? (Big Dunkard) (Mahoning)	40	635	
Unrecorded	35	670	267′
Allegheny Series (225′)			
Unrecorded	15	685	
Sandstone, Big Dunkard? (Burning Springs) (Upper Freeport)	50	735	
Unrecorded	30	765	
Coal (Upper Kittanning)	4	769	99′
Unrecorded	126	895	126′
Pottsville Series (400′)			
Sand, Salt? (Second Cow Run) (Homewood) (12 bailers water per hour)	50	945	
Unrecorded	30	975	
Sand, Second Salt? (Salt) (little gas and oil show at top)	160	1135	
Unrecorded	20	1155	
Sand, Third Salt? (Sharon)	140	1295	400′
Lower Carboniferous (735′)			
Mauch Chunk (295′)			
Red rock	60	1355	
Sand, Maxton	85	1440	
Red rock	115	1555	
Little Lime	18	1573	
Unrecorded	17	1590	295′
Greenbrier Limestone (90′)			
Big Lime	90	1680	90′
Pocono Sandstones (350′)			
Sand, Big Injun (little gas at top)	95	1775	
Unrecorded	40	1815	
Sand, Squaw	30	1845	
Unrecorded	185	2030	350′
Devonian (1715′)			
Catskill, Chemung and Portage (1715′)			
Sand, (probably Berea, Gantz and Fifty-foot)	150	2180	
Unrecorded	212	2392	362′
Sand, Stray? (Gordon)	27	2419	
Unrecorded	11	2430	
Sand, Gordon? (Fourth)	25	2455	
Unrecorded	65	2520	
Sand, Fourth? (Fifth)	20	2540	148′
Slate and shells	845	3385	
Sand shell	1	3386	
Slate and lime shells to bottom	359	3745	1205′

The section is interesting in that the basal formation reaches almost as low—3685 feet below the Pittsburgh coal—in the rock column as that given for Grassland on a preceding page of this report. The bottom of the well is over 1000 feet below the base of the Catskill measures and probably not over 1500 feet above the top of the Corniferous limestone.

The following section was measured with aneroid by the writer in the extreme southeastern corner of Harrison county from the summit of a high knob located on the head of Charity fork of Right branch of Gnatty creek on the Harrison-Upshur county line northwestward along the public highway to Peeltree run level, 1.5 miles due east from Johnstown:

Section One Mile and a Half East of Johnstown, Elk District.

	Thickness. Feet.	Total. Feet.	
Dunkard and Monongahela Series (530')			
Concealed and sandstone from top of knob..	130	130	
Concealed	30	160	
Reds	5	165	
Sandstone, flaggy	30	195	
Concealed	10	205	
Reds, dark, limy	5	210	
Shale, red	15	225	
Shale, blue, sandy	10	235	
Concealed	55	290	
Reds	5	295	
Sandstone, massive	20	315	
Sandstone, shaly	10	325	
Concealed and shale	15	340	
Limestone, gray and hard, slightly siliclous, Benwood	15	355	
Concealed	5	360	
Sandstone, green, medium grained, Upper Sewickley	20	380	
Shale, limy, green	20	400	
Sandstone, green, micaceous, flaggy, Lower Sewickley	30	430	
Shale, gray and limy, and sandstone	20	450	
Concealed	22	472	
Shale, dark	23	495	
Coal blossom, heavy, Redstone	5	500	
Concealed	30	530	530'
Conemaugh Series (235')			
Concealed	105	635	
Sandstone, with layers of red shale, Connellsville	25	660	
Shale, red and sandy	5	665	
Concealed and shale	29	694	
Slate, black, with fossil plants, Little Clarksburg coal horizon?	1	695	165'
Fire clay shale	10	705	
Shale, sandy, buff	15	720	
Sandstone, massive, green	5	725	
Concealed	5	730	
Reds, dark with limestone nuggets	30	760	
Concealed to road crossing of Peeltree	5	765	70'

The section was measured northwestward along the dip of the strata and for that reason the formations are thicker and the intervals are greater than they should be. The total dip in this direction is almost 75 feet, so that this high knob probably catches 50 to 75 feet of the Dunkard series, and the base of the latter should come near the middle of the 130 feet of measures at the top.

SUMMARY.

The following table gives not only the thickness of the Upper Carboniferous, Lower Carboniferous and Devonian as exhibited by the foregoing general sections, but it also gives in most cases the thickness of the several series under each. In this table the sections are arranged alphabetically with reference to the nearest town or post office:

Table Showing Thickness in Feet of the Stratified Rocks in the Doddridge-Harrison Area.

PLACE MEASURED	UPPER CARBONIFEROUS						LOWER CARBONIFEROUS				DEVONIAN		
	Dunkard.	Monongahela.	Conemaugh.	Allegheny.	Pottsville.	Total :	Mauch Chunk.	Greenbrier Limestone.	Pocono	Total	Catskill.	Chemung & Portage.	Total
Adamston	...	325	150	...	...	475	...	...	...	...	...	...	....
Adamsville	...	382	593	181	299	1455	350	66	400	716	179	...	179
Benson	125	485	580	220	410	1820	220	55	450	725	377	...	377
Big Battle	382	...	...	...	...	382	...	...	...	...	...	...	....
Big Isaac	330	465	525	250	490	2060	110	65	525	700	429	...	429
Boothsville	...	...	330	220	...	...	...	...	...	...	720	...	720
Bridgeport	...	...	562	215	273	1050	362	85	360	797	740	...	740
Brown	460	413	595	300	242	2007	134	49	498	681	120	...	120
Byron	...	317	547	220	...	...	...	94	411	...	527	...	527
Canton	110	360	565	273	240	1548	192	53	507	752	220	...	220
Centerpoint	80	414	...	...	293	1601	164	58	87	309	...	...	....
Clarksburg	...	365	550	233	372	1520	285	55	360	700	703	...	703
Coldwater	467	438	...	...	...	...	...	...	285	...	546	...	546
Deweytown	415	418	550	260	359	2002	...	...	485	645	514	...	514
Fonda	822	427	576	265	240	2330	125	72	498	695	342	...	342
Goodhope	...	269	591	...	...	...	...	37	422	...	406	...	406
Grassland	...	295	565	220	630	1710	48	77	359	484	686	1618	2304
Greenwood	480	390	515	245	330	1960	98	72	515	685	457	...	457
Grove	360	...	...	...	...	360	...	...	...	...	...	...	....
Heldreth	873	395	...	...	...	1268	...	...	...	...	...	...	....
Johnstown	...	...	235	...	...	765	...	...	...	...	...	...	....
Katys Lick	110	395	...	...	...	505	...	...	...	...	...	...	....
Kelly	150	205	...	...	...	355	...	...	...	...	...	...	....
Long Run	286	409	565	284	...	...	...	77	658?	...	326	...	326
Lost Creek	...	...	330	225	365	920	270	60	367	697	540	...	540
Lumberport	...	...	543	215	...	...	...	68	452	...	558	...	558
Miletus	555	447	...	...	...	...	...	...	540	...	470	...	470
Numan	450	...	...	...	...	450	...	...	...	...	...	...	....
Quiet Dell	...	...	...	...	450	1000	285	65	445	795	530	...	530
Romines Mills	...	60	610	225	400	1295	295	90	350	735	...	...	1715
Saint Clara	475	435	...	...	...	...	...	...	463	...	6	...	6
Salem	312	414	543	279	250	1798	106	132	469	707	641	...	641
Sedalia	466	390	...	...	...	856	...	...	...	...	...	...	....
Summers	145	145	...	...	...	290	...	...	...	...	...	...	....
West Milford	...	200	590	250	400	1440	200	...	...	700	630	...	630
West Union	405	403.7	...	...	...	808.7	...	...	...	...	...	...	....
Wilsonburg—NE	...	400	587	258	309	1554	200	55	446	701	562	...	562
Wilsonburg—S	...	75	554	236	340	1205	210	60	485	755	504	...	504
Wolf Summit—S	76	348	...	...	...	450	...	...	...	...	...	...	....
Wyatt	...	...	570	240	360	1610	93	112	491	696	520	...	520

The sections, with others published on subsequent pages, give a maximum thickness of the Carboniferous in this portion of the State of 3950 feet, divided as follows:

	Feet.	
Upper Carboniferous:		
Dunkard Series	1160	
Monongahela Series	430	
Conemaugh Series	600	
Allegheny Series	275	
Pottsville Series	500	2965 feet.
Lower Carboniferous:		
Mauch Chunk	350	
Greenbrier Limestone	135	
Pocono Sandstones	500	985 "
Total		3950 feet.

CHAPTER V.

STRATIGRAPHY—THE DUNKARD SERIES.

The Dunkard series of rocks is the highest division of the Upper Carboniferous of the Appalachian area of North America, and the most recent in formation within the Doddridge-Harrison area, except the alluvium along the bottom lands of the rivers and large creeks. This group of rocks was so designated from Dunkard creek, a stream flowing eastward into the Monongahela river in the southwest corner of the State of Pennsylvania, by I. C. White, whose original description is as follows[1]:

> "The uppermost beds are found at the headwaters of Dunkard creek, a large stream which heads near the West Virginia-Pennsylvania line, on the eastern slope of the water-shed separating the Ohio and Monongahela river drainage systems, and flowing eastward, puts into the Monongahela two miles above Greensboro, Greene county, Pennsylvania, and four miles north from the West Virginia line. This stream flows over the Permo-Carboniferous rocks from its source to the point at which it leaves the West Virginia line at Mount Morris, Pennsylvania, a distance of more than thirty miles, furnishing very fine exposures of these rocks along its banks and bluffs; hence the geographical name, Dunkard, which I have given the series."

The series was originally called the Upper Barren measures in the early study of the geology of this region on the supposition that this division of the rock column held no coal beds of economic value. For a long time the series was placed under the compromise term, Permo-Carboniferous, on account of the presence of fossil plants of Permian age in its shales and slates, and the failure to find Permian fauna.

The base of the Dunkard series was placed by I. C. White where Permian plants were first observed in the fossil flora, viz., the Cassville shale, just over the Waynesburg coal bed.

---

[1] U. S. G. Survey, Bulletin No. 65, page 20; 1891.

He gives the following description of the Dunkard series in West Virginia[2]:

> "As exhibited in West Virginia, the rocks of this series consist of a succession of brown and gray sandstones, interstratified with much red shale, many beds of limestone, and several thin, impure and unimportant coal beds, the entire series being slightly gypsiferous throughout, though no accumulations of gypsum have taken place owing probably to the absence of any considerable thickness of limestone beds.
>
> "In Ohio and northern Marshall counties, like Greene and Washington of Pennsylvania, this series holds less red shale and a greater proportion of limestone and gray limy shales than further to the southwest. The coal beds are also more numerous, and the sandstones less massive, the whole resulting in a gentle rolling topography, finely adapted to grazing and agriculture, except along the immediate gorges of the streams.
>
> "As we pass southwestward, however, the coal beds all disappear except one (the Washington) before we reach the Little Kanawha river, and the limestones with one or two exceptions thin away into great masses of marly red shales, holding only nuggets of lime, while the sandstones thicken up, and, capping the ridges in long lines of cliffs, often make a rugged topography better fitted for grazing and fruit culture than for agriculture. When the massive sandstones disappear from the ridges or uplands, however, there frequently occur limited areas of beautiful rolling lands which yield abundant crops, the red marly shales being quite fertile from the disseminated limestone nuggets.
>
> "The soils formed by the disintegration of the Dunkard beds have the reputation of producing a fine quality of wool in which the fiber is peculiarly firm and strong, so that its area is often known as the "sheep belt" of West Virginia, since probably 90 per cent of the sheep raised in the State are grown upon the outcrops of the Dunkard series. These rocks occupy a belt about 40 to 60 miles in width bordering the Ohio river and extending east from the same over portions or all of the following named counties: Ohio, Marshall, Wetzel, Tyler, Monongalia, and Marion (west of the Monongahela river), western Harrison and Lewis, Doddridge, Pleasants, Wood, Wirt, Ritchie, Calhoun, Gilmer, Roane, Jackson, and the uplands of Mason and southern Putnam, but tailing out into a narrow belt, which soon overshoots even the highest hills of Wayne, a short distance east from the Big Sandy river at the Kentucky boundary."

The writer has compiled the following general section of the Dunkard series for West Virginia from a large number of detailed sections of these measures as published in the several reports of the State Geological Survey. Since the publication of the original Dunkard Creek section by I. C.

---

[2] Vol. II., page 101, W. Va. Geol. Survey; 1903.

White[2a] in 1891, the formations below, the names of which are in parentheses, have been added and described by the writer in the reports of the Marshall-Wetzel-Tyler and Wirt-Roane-Calhoun areas, except the Elm Grove and Bristol limestones. The former was added and described by G. P. Grimsley in the Ohio-Brooke-Hancock report, and the latter by the writer in this report:

General Section of the Dunkard Series for West Virginia.

	Thickness. Feet.	Total. Feet.	
Sandstones, (Proctor)	150	150	
Limestone, Windy Gap	5	155	
Shale	25	180	
Coal, Windy Gap	1	181	181′
Fire clay, shale, red and variegated with thin limestones and sandstones	79	260	
Sandstone, massive, Gilmore	30	290	
Coal, (Gilmore)	1	291	110′
Limestone, (Gilmore)	1	292	
Shale, variegated and red, with thin sandstones	93	385	
Limestone, (Upper Rockport)	5	390	
Sandstone, (Taylor)	30	420	129′
Limestone, (Middle Rockport)	5	425	
Sandstone and shale, buff and red	30	455	
Limestone, (Lower Rockport)	5	460	
Shale, sandstone and shale, limy	15	475	
Sandstone, massive, coarse brown, Nineveh.	25	500	
Shale to	5	505	
Coal, Nineveh	1	506	86′
Fire clay and limy shale	10	516	
Limestone, Nineveh	5	521	
Shale, variegated and red	30	551	
Sandstone, massive, (Burton)	29	580	
Coal, Hostetter	1	581	75′
Shale, sandy, with thin sandstones	59	640	
Sandstone, massive, Fish Creek	35	675	
Coal, (Fish Creek)	1	676	89′
Fire clay, shale, sandy and red, with thin sandstones	34	710	
Sandstone, massive, (Rush Run)	25	735	
Shale, sandy	5	740	
Coal, Dunkard	1	741	65′
Fire clay, shale, sandy, variegated and red..	30	771	
Sandstone, Jollytown	20	791	
Coal, Jollytown	1	792	51′
Fire clay	1	793	
Limestone, Upper Washington	4	797	

[2a] Bull. No. 65, U. S. G. Survey, page 22.

	Thickness. Feet.	Total. Feet.	
Shale, limy	5	802	
Sandstone, (Hundred)	35	837	
Coal, (Hundred)	1	838	46′
Fire clay, shale, red and variegated	35	873	
Sandstone, (Upper Marietta)	50	923	
Coal, Washington "A"	1	924	86′
Red Shale (Creston)	60	984	
Limestone, Middle Washington	5	989	
Sandstone, (Lower Marietta)	40	1029	
Limestone, Lower Washington	2	1031	
Coal, Washington	3	1034	110′
Fire clay shale, (Washington)	8	1042	
Limestone, (Bristol)	2	1044	
Sandstone, Washington	10	1054	
Coal, Little Washington	1	1055	
Shale	5	1060	
Sandstone, Mannington—Waynesburg "B" coal horizon near middle	45	1105	
Shale	4	1109	
Coal, Waynesburg "A"	1	1110	76′
Fire clay and shale	3	1113	
Limestone, Mount Morris	2	1115	
Shale	12	1127	
Sandstone, coarse, brown and pebbly, Waynesburg	45	1172	
Limestone, dark flaggy, Elm Grove	3	1175	
Shale, Cassville	5	1180	70′
Coal, Waynesburg.			

The Dunkard series of rocks crops over almost the entire area of Doddridge county and over a large portion of the western half of Harrison. The extent of this group of rocks in the area under discussion is graphically shown on the General and Economic Geology map accompanying this report. There it will be noted that the series passes into the air along the crest of the Chestnut Ridge anticline and along the crest of the Wolf Summit arch south from Tenmile creek. In the extreme southeastern corner of Harrison some of the high knobs on the Upshur county line catch a few acres of the Dunkard rocks in their summits.

In the Doddridge-Harrison area, the Dunkard series consists of sandstones, sandy shales, limestones, limy shales, red shales and only three or four thin coal beds. The characteristic red shales appear in all sections observed by the writer. Most of the limestones of Marshall, Wetzel and Monongalia counties, have in the area under discussion turned into marly red shales with nuggets of limestone scattered throughout. The maximum thickness of these measures left uneroded (about 1160 feet) occurs in the northwestern corner of Harrison county. There the log of the E. L. Piggott No. 1 well (321) which starts 45 feet (hand-level measurement) below the summit of a high knob, reports the Pittsburgh coal bed at a depth of 1498 feet. The thickness of the Monongahela series there is about 390 feet, so that 1160 feet of the Dunkard measures must be represented, and the knob must be capped by the Proctor sandstone group.

DODDRIDGE COUNTY SECTIONS, DUNKARD SERIES.

Several sections of the Dunkard series in Doddridge county are given in Chapter IV of this report. In addition several scattered sections of this group of rocks will now be given.

The following section was measured by D. B. Reger southeast along the hill road on the head of a branch of Broad run.

Section Two Miles North of Ashley, McClellan District.

	Thickness. Feet.	Total. Feet.	
Concealed from summit of high knob (base, 1246′ L-A. T.)	150	150	
Shale, red	5	155	
Shale, brown	20	175	
Sandstone	10	185	
Concealed	5	190	
Sandstone, soft, friable, (Nineveh?)	20	210	210′
Concealed, mostly red shale	60	270	
Sandstone, flaggy, soft, brown, micaceous. (Burton?)	15	285	75′
Sandstone, shaly	5	290	
Sandstone, red	5	295	
Sandstone, shaly	15	310	
Shale, red	20	330	
Sandstone, shaly	5	335	
Shale, red	10	345	
Sandstone, shaly (Fish Creek)	10	355	70′

	Thickness. Feet.	Total. Feet.	
Shale, variegated	20	375	
Concealed	15	390	
Shale, brown	15	405	
Sandstone, fine, green, flaggy (Jollytown)	10	415	
Concealed	5	420	
Coal blossom, streak, (Jollytown?)	0	420	65′
Shale, green	2	422	
Concealed	3	425	
Sandstone, shaly (Hundred?)	5	430	
Shale, variegated to foot of hill road	25	455	35′

The base of the section is 700 to 750 feet above the horizon of the Pittsburgh coal bed; hence the formation 420 feet from the top appears to correlate with the Jollytown coal horizon, since at its type locality the latter bed comes 750 to 775 feet above the Pittsburgh seam.

The following very interesting section was measured by D. B. Reger with aneroid in the southeastern corner of McClellan district westward from the summit of a high knob and along the public road leading down Elkhorn run, two miles northeast of Cascara P. O.:

Section Two Miles Northeast of Cascara P. O., McClellan District.

	Thickness. Feet.	Total. Feet.	
Sandstone, capping knob, coarse, soft, micaceous, brown and mottled (Proctor)	20	20	
Concealed	10	30	
Fire clay, (Windy Gap coal horizon)	5	35	35′
Concealed	15	50	
Sandstone, fine grained, hard	10	60	
Shale, red	5	65	
Sandstone, very fine grained, flaggy, micaceous	25	90	
Concealed and red shale	15	105	
Sandstone, greenish gray and flaggy	25	130	
Concealed and red shale	20	150	
Sandstone, buff, friable (Gilmore)	25	175	
Concealed	17	192	157′
Fire clay (Gilmore coal horizon)	3	195	
Shale, brown	20	215	
Sandstone	5	220	
Shale, red	10	230	
Sandstone, flaggy, (Taylor)	20	250	
Shale, red	10	260	
Sandstone	5	265	
Reds and concealed to road at low gap	80	345	

	Thickness. Feet.	Total. Feet.	
Sandstone, green, flaggy, fine grained (Nineveh)	25	370	178'
Concealed	45	415	
Sandstone, hard, micaceous, green and fine	5	420	
Shale, gray (plant fossils, mostly ferns)	1	421	
Concealed	29	450	
Shale, red	10	460	
Concealed and brown shale	30	490	
Sandstone, hard, green, fine	5	495	
Shale, brown	5	500	
Fire clay, streak	0	500	
Shale, red	20	520	
Sandstone, shaly	5	525	
Concealed	10	535	
Shale, brown	10	545	
Sandstone, flaggy (Rush Run)	50	595	
Coal blossom (1"), Dunkard	0	595	225'
Fire clay, yellow, and shale	5	600	
Shale, red, to level of Jamison Hutson No. 1 well (43)	30	630	
Interval (calculated from wells Nos. 21 and 43)	390	1020	
Coal, Waynesburg.			

The section reaches 30 feet above the horizon of the Windy Gap coal, the latter being the highest known bituminous formation yet observed in the Carboniferous rocks of the Appalachian area. The formation 595 feet from the top comes 805 feet above the Pittsburgh coal, which interval checks closely for the horizon of the Dunkard coal at its type locality. The section lacks 140 feet of reaching as high up in the Dunkard series as the high knob in the northwest corner of Harrison county on which the E. L. Piggott No. 1 well (321) is located. However, the uppermost formation appears to correlate with the lower ledge of the Proctor sandstones.

The following section of the Dunkard series was measured with aneroid by the writer northwest along the hill road to Long run of Arnolds creek, one-fourth mile southwest of Orontes P. O.:

Section 1.5 Miles Northwest of Central Station, Central District.

	Thickness. Feet.	Total. Feet.	
Concealed from top of knob	140	140	
Sandstone, flaggy, along road (Rush Run)	15	155	
Concealed	35	190	
Reds	5	195	
Sandstone, shaly (Jollytown)	20	215	
Reds	10	225	225'
Fire clay shale (Jollytown coal horizon at top)	5	230	
Reds, dark, with limestone nuggets, top	13	243	
Sandstone	2	245	
Shale, red	22	267	
Sandstone, shaly	3	270	
Shale, red	25	295	
Fire clay and red shale	5	300	
Concealed	25	325	
Sandstone, massive (Upper Marietta)	32	357	132'
Concealed	3	360	
Shale, dark (6")	0	360	
Unrecorded	67	427	
Coal, Washington (Base is 845' L-A. T.)	3	430	73'
Interval	130	560	130'
Coal, Waynesburg.			

The Washington coal bed has been correctly identified and for that reason the formations at 140', 225' and 325' from the top have been correlated with the horizons of the Rush Run sandstone, Jollytown coal, and Upper Marietta sandstone, respectively.

The following section of the Dunkard series was measured with aneroid by the writer in the extreme southern point of New Milton district northward along the hill road leading down a branch of Roberts fork of Little Indian fork, two miles southwest of Coldwater P. O.:

Section Two Miles Southwest of Coldwater P. O., New Milton District.

	Thickness. Feet.	Total. Feet.
Concealed from summit of high knob on west	100	100
Sandstone, coarse, brown, flaggy (Jollytown)	40	140
Concealed, mostly sandstone	10	150
Shale, red and concealed	10	160
Sandstone	20	180
Shale, red	5	185
Sandstone, forms steep bluff (Hundred)	35	220

	Thickness. Feet.	Total. Feet.	
Concealed	40	260	
Sandstone	15	275	
Concealed	45	320	
Shale, red	5	325	
Sandstone, Lower Marietta	20	345	
Shale, red	5	350	
Concealed	27	377	
Coal, Washington	3	380	
Interval	130	510	130′
Coal, Waynesburg.			

The heavy sandstone, 240 feet above the base of the Washington coal, appears to correlate with the Jollytown ledge which has a tendency to become quite massive southwestward from Greene county, Penna.

The following section of the Dunkard series was measured with aneroid by the writer in the east end of Greenbrier district northward along the hill road, three-fourths mile southwest from Big Isaac:

Section Three-fourths Mile Southwest of Big Isaac, Greenbrier District.

	Thickness. Feet.	Total. Feet.	
Concealed and sandstone from summit of high knob	145	145	
Fire clay and buff shale	15	160	
Sandstone, forms bluff, Lower Marietta	15	175	
Concealed	20	195	
Coal blossom, Washington	0	195	195′
Concealed and shale	30	225	
Sandstone, massive, coarse brown, Mannington	40	265	
Fire clay, (Waynesburg "A" coal horizon)	0	265	
Concealed and sandstone, Waynesburg	45	310	
Shale, sandy, Cassville	5	315	120′
Coal, Waynesburg.			

HARRISON COUNTY SECTIONS, DUNKARD SERIES.

The following section of the Dunkard series was obtained in the extreme northwest corner of Harrison county by combining the log of the E. L. Piggott No. 1 well (321) as furnished by the Southern Oil Company with a hand-level section measured by the writer. In this well the top of the Pittsburgh coal was encountered at 1498 feet, the greatest depth to this horizon of any well yet reported to the State Geological Survey office. The thickness of the Monongahela series there should be about 390 feet; hence, the base of the Dunkard series should occur at a depth of 1115 feet:

Section One-half Mile Northwest of Alliance P. O., Sardis District.

	Thickness. Feet.	Total. Feet.
Concealed, mostly sandstone (Proctor), capping knob to E. L. Piggott No. 1 well (321)	45	45
(E. L. Piggott No. 1 Well Log (321))		
Unrecorded	1115	1160
Waynesburg coal horizon.		

The above (1160 feet) is the greatest thickness reached by the Dunkard series in the two counties, and lacks only 20 feet of being as great as yet recorded for these measures in the State. The Steels Run section of Wetzel county, as published by the writer on page 106 of the Marshall-Wetzel-Tyler report, gives the series a thickness of 1180 feet.

The following section of the Dunkard series was measured with aneroid by the writer in the northwestern corner of Eagle district northeastward along the hill road, located one mile and a half southwest of Margaret P. O.:

Section 1.5 Miles Southwest of Margaret P. O., Eagle District.

	Thickness. Feet.	Total. Feet.	
Concealed from summit of knob to road at low gap (U. S. 1323' L-A. T.)	200	200	
Concealed along road	50	250	
Sandstone, shaly (Burton)	20	270	270'
Concealed	30	300	
Shale, sandy	20	320	
Fire clay and concealed	15	335	
Shale, red	5	340	
Concealed and fire clay	9.5	349.5	
Coal (6"), Fish Creek	0.5	350	80'
Fire clay shale	5	355	
Sandstone, rounded	5	360	
Shale, sandy	10	370	
Concealed to C. L. Starkey No. 1 well (541)	50	420	
Interval	386	806	456'
Coal, Waynesburg horizon.			

According to the log of the C. L. Starkey well (541), the Pittsburgh coal was encountered at a depth of 770 feet; hence, the formation 3495′ from the top of the section comes 840 to 850 feet above that coal, and most probably correlates with the Fish Creek coal. The basal formation was not recorded in the well, but its horizon was determined on the assumption of a thickness of 390 feet for the Monongahela measures for this region.

The following section of the Dunkard series was measured by D. B. Reger in the western part of Sardis district with aneroid from the summit of a high knob on the head of Rockcamp run:

Section One Mile Northwest of Fonda, Sardis District.

	Thickness. Feet.	Total. Feet.
Sandstone, buff, coarse, friable, capping knob, Lower Proctor	65	65
Shale, brown	15	80
Sandstone, coarse brown, micaceous	25	105
Concealed	5	110
Sandstone, brown	25	135
Shale, brown	5	140
Sandstone, brown, micaceous	15	155
Concealed	5	160
Shale, red	20	180
Sandstone, green	5	185
Shale, red	5	190
Sandstone, shaly	15	205
Shale, red	15	220
Sandstone, shaly	5	225
Shale, red	10	235
Sandstone, shaly	10	245
Concealed and red shale	20	265
Sandstone, shaly	10	275
Concealed and red shale	20	295
Sandstone, shaly	15	310
Concealed	5	315
Sandstone	5	320
Shale, brown	15	335
Concealed	75	410
Shale, brown	20	430
Concealed to Henry Stewart No. 1 well (358)	25	455
Interval	570	1025
Waynesburg coal horizon.		

The Survey was unable to obtain the log of the Henry Stewart No. 1 well (358) to which the section is connected, but the horizon of the basal formation is estimated from the position of the structure contours of the Pittsburgh coal bed. The well mouth is 1160'B—A. T. There is not much doubt but that the great sandstone (formation No. 1) at the top of the section correlates with one of the Proctor sandstones, probably representing the lower ledge of that group.

DESCRIPTION OF THE DUNKARD FORMATIONS.

The several formations of the Dunkard series will now be described in detail, and for comparative purposes, a brief account will be given of other type formations of this series that appear to be absent in the area under discussion.

The Proctor Sandstones.

The topmost beds of the Dunkard series so far as known and described, consisting of sandy beds and coarse, brown, micaceous and friable massive sandstones separated by red shales, and having a total thickness of about 150 feet, have been designated by the writer[3] the Proctor sandstones from the magisterial district of that name in north central Wetzel county, West Virginia, in which they crop close the summit of a high knob near West P. O.

In the area under discussion their crop is confined to the summits of a few of the highest knobs along the Harrison-Wetzel and Harrison-Doddridge county lines. The sections given for Cascara and Fonda (pages 137 and 142) include the basal portion of the Proctor sandstone group, while that for Alliance (page 141) includes almost the entire series.

The Windy Gap Limestone.

The next recognized formation of the series in descending order is the Windy Gap limestone. Its horizon is immediately under the Proctor sandstone group. It was so named by I. C. White[4] from its ocurrence near Windy Gap, a "divide" separating Laurel branch of Fish creek from Wheeling creek, Springhill township, Greene county, Penna., where it is dark bluish in color, weathering to a light gray, and aggregates 8 to 10 feet in thickness.

---

[3] Marshall-Wetzel Tyler Report, p. 167; 1909.

[4] Bull. 65, p 30, U. S. Geol. Survey; 1891.

The only place in the area that the horizon of the Windy Gap limestone crops is along the dividing ridge between the two counties, and if present there, the ledge is effectually concealed by debris at all points visited. In Wetzel county it belongs about 1300 feet over the Pittsburgh coal bed, but in Doddridge and Harrison it probably comes 1350 to 1375 feet above the same datum, due largely to the increase in thickness of the Monongahela series in this region.

The Windy Gap Coal.

The Windy Gap coal is the highest—geologically—known and described bituminous formation in the Appalachian coal field and likewise in West Virginia. It has been so named by I. C. White[5] from the type locality of the Windy Gap limestone where it occurs 25 to 30 feet below the latter stratum.

The crop of this coal bed is confined to practically the same area in the two counties as given for the limestone above. In the section given for Cascara, page 137, the formation 30 feet from the top appears to correlate with the Windy Gap coal horizon, although no coal was observed by Mr. Reger at this point. The sections given for Alliance and One Mile northwest of Fonda, pages 141 and 142, respectively, reach above the horizon of this bed, yet it is effectually concealed at the former place, and if present in the latter, it belongs in the concealed interval 80 feet from the top. In the Fonda section the Windy Gap limestone has apparently disappeared from the measures.

---

[5] Bull. 65, U. S. Geol. Survey, page 31; 1891.

The Gilmore Sandstone.

The Gilmore sandstone is the next important stratum in descending order in the Dunkard series and has been so designated by J. J. Stevenson from the township of that name in Greene county, Penna., where it is conspicuous in a long line of cliffs near the summits of the hills. It is a massive bed of coarse, yellowish brown sandstone, whose cliffs are frequently traversed by fissures that often furnish a refuge for foxes, and for that reason it is sometimes called the "Fox Rocks". There it is 215 feet above the Nineveh coal and 1190 to 1200 feet above the Pittsburgh bed.

In the Doddridge-Harrison area the crop of this stratum is confined to near the summits of the high hills along the axis of the Burchfield syncline north of McElroy creek, and the axis of the Robinson syncline northward from the latitude of Salem, where it frequently forms an escarpment around the hill sides. In the Cascara section, page 137, it has an exposed thickness of 25 feet as exhibited by the formation 150 feet from the top, coming 1225 feet above the Pittsburgh coal bed. No quarries on this stratum were seen.

The Gilmore Coal.

Immediately at the base of the Gilmore sandstone there sometimes occurs a thin streak of coal that has been named by the writer[6] the **Gilmore** from its association with the sandstone above. Its horizon is 215 to 230 feet over the Nineveh coal and 1190 to 1210 feet above the Pittsburgh bed.

In the Doddridge-Harrison area the crop of this stratum is confined to the same area as given for the Gilmore sandstone above, but no coal was observed at this horizon at any point in the two counties. The section given for Cascara, page 137, records 3 feet of fire clay as revealed by the formation 195 feet from the top, that apparently occurs at the horizon of the Gilmore coal, coming as it does 1205 feet over the Pittsburgh coal bed.

---

[6] W. Va. Geol. Survey, Marshall-Wetzel-Tyler Report, pp. 172-173; 1909.

The Gilmore Limestone.

In the vicinity of Littleton and Uniontown, Wetzel county, and near Oak Forest M. E. church, one-fourth mile east of St. Cloud, Monongalia county, there occurs 6 inches to 1 foot of dark gray and slightly silicious limestone that has been designated the **Gilmore** by the writer[7] from its association with the overlying coal and sandstone. It was not observed at any point in the Doddridge-Harrison area, but its horizon crops over the same area as that outlined for the sandstone of that name above.

The Upper, Middle and Lower Rockport Limestones.

In the 150 to 200 feet of measures that intervene between the Gilmore Limestone and the Nineveh coal there sometimes occurs a series of limestone ledges that have been designated by the writer on page 143 of the report on Wirt, Roane and Calhoun counties, the **Upper Rockport, Middle Rockport** and **Lower Rockport,** from their fine development near the village of Rockport in southern Wood county, W. Va. The reader is referred to that Report for their description, and the section given on page 46.

In the Doddridge-Harrison area the crop of the horizon of these limestones is confined to the high hills in the northwest portions of the two counties along the axes of the Burchfield and Robinson synclines. There, however, they have apparently been replaced by red sandy beds.

The Taylor Sandstone.

On Taylor run in Greene county, Penna., a very persistent sandstone occurs in the Dunkard series, 120 feet below the Gilmore sandstone and 70 feet above the Nineveh coal bed, that has been designated by the writer[8] the **Taylor** from that locality.

---

[7] W. Va. Geol. Survey, Marshall-Wetzel-Tyler Report, p. 173; 1909.

In the Doddridge-Harrison area its crop is confined to the dividing ridge between the waters of Middle Island creek and West Fork river northward from the latitude of Salem, along the axis of the Robinson syncline. Likewise along the axis of the Burchfield syncline northward from McElroy creek. In the Cascara section, page 137, this stratum is evidently represented by the formation 230 feet from the top. There it is 20 feet thick and flaggy, coming 1150 feet above the Pittsburgh coal bed. No quarries were noted at this horizon.

The Nineveh Sandstone.

At 40 to 50 feet below the Taylor another great sandstone that has a wide persistence comes into the measures. It has been designated the **Nineveh** sandstone by I. C. White from its development a few feet above a coal of that name near the village of Nineveh, Greene county, Penna.

In the Doddridge-Harrison area its crop is confined to the high hills along the Burchfield and Robinson synclinal basins. It is apparently this stratum that forms the great cliffs and "Devil's Tea Table" rock one-half mile southwest of the low gap traversed by the Northwestern turnpike, 1¾ miles southeast of Greenwood. There it is 40 feet thick, coarse, and brown with small pebbles of limestone, ⅛ to 1 inch in diameter, scattered throughout, and comes 450 feet above the Washington coal.

No quarries were observed at this horizon.

The Nineveh Coal.

A short distance, 5 to 20 feet, below the base of the Nineveh sandstone there frequently occurs a thin coal bed in northern West Virginia, that has been designated the **Nineveh coal** by J. J. Stevenson from a village of that name in Greene county, Penna., near which place it crops to the surface. In eastern Wetzel county its horizon is 325 feet below the Windy Gap coal and 990 to 1000 feet over the Pittsburgh coal.

---

[8] Marshall-Wetzel-Tyler Rept., W. Va., Geol. Survey, page 173; 1909.

In the Doddridge-Harrison area this coal appears to be absent from the measures, since no coal was observed at or close to its horizon in the two counties. In the Cascara section, page 137, its horizon belongs in the concealed interval at 421 to 450 feet from the top. Its crop is confined to the same area as outlined for the Nineveh sandstone.

The Nineveh Limestone of Stevenson was not observed in the Doddridge-Harrison area, since its horizon was effectually concealed by debris at all points visited while in the field.

The Burton Sandstone.

In the northern end of the State there occurs a very persistent stratum that has been designated the **Burton sandstone** by the writer[9] from a town of that name in northeastern Wetzel county near which place it is a prominent topographical feature.

In the Doddridge-Harrison area this sandstone often forms an escarpment around the hillsides along the axes of the Burchfield and Robinson synclines. In the section given for Margaret in the northwestern corner of Harrison, page 141, the formation 250 feet from the top apparently correlates with the Burton sandstone, coming as it does 80 feet over the Fish Creek coal, and 920 to 930 feet above the Pittsburgh coal. No quarries were observed in this stratum.

The Hostetter coal bed, 6 to 18 inches in thickness, comes immediately at the base of the Burton sandstone, near Burton, Wetzel county, W. Va., but no coal was observed at this horizon in the Doddridge-Harrison area. The thin coals of the Dunkard series mostly disappear southwestward from Monongalia and Wetzel counties, or if present, their horizons are effectually concealed by debris.

---

[9] Marshall-Wetzel-Tyler Report, W. Va., Geol. Survey, page 145; 1909.

The Fish Creek Sandstone.

In southwestern Greene county, Penna., and northeastern Wetzel county, W. Va., there occurs a widely persistent massive sandstone, 40 to 50 feet below the Hostetter coal and 840 to 850 feet above the Pittsburgh bed, that has been designated the **Fish Creek sandstone** by J. J. Stevenson from its crop in a great cliff near Deep Valley, Springhill township, Greene county, Penna. A detailed description of this stratum is given by the writer on pages 185-187 and 593-594 of the Marshall-Wetzel-Tyler report of the W. Va. Geological Survey.

In the Doddridge-Harrison area the crop of this stratum is confined to the hills and ridges in the deep Burchfield and Robinson structural basins, along which it frequently forms a prominent escarpment. No quarries on this sandstone were noted.

The Fish Creek Coal.

Immediately at the base of the great Fish Creek sandstone in the vicinity of Littleton, Wetzel county, W. Va., there occurs a double bedded coal seam that has been designated by the writer[11] the **Fish Creek coal** from a stream of that name on which it has been mined both at Littleton and near Deep Valley, Greene county, Penna. It was formerly correlated with the Dunkard coal, 45 to 50 feet lower in the measures, but for reasons that will appear in the reference at the bottom of this page, it has been shown to represent a separate and distinct coal bed.

In the Doddridge-Harrison area it crops around the hillsides in the Burchfield and Robinson synclines, but passes below drainage in the northwestern corner of Harrison county near Rinehart station. One-half mile southeast of the latter place, and along the east edge of the public highway, the following section of the Fish Creek coal was measured by the writer:

---

[11] Marshall-Wetzel-Tyler Rept., W. Va. Geol. Sur., pp. 187-191; 1909.

					Feet.	Inches.
1.	Sandstone, massive, Fish Creek.........				30	0
2.	Shale, buff............................				2	0
3.	Shale, dark........	0′	1″	Fish Creek...	4	1
4.	Shale, soft gray...	1	3			
5.	Shale, dark........	0	1			
6.	Shale, soft gray...	1	8			
7.	Coal	1	0			
8.	Fire clay and concealed to creek level...				8	0

Formations Nos. 3-6 inclusive may not really be a part of this coal bed. In the southern portion of New Milton district, Doddridge county, one foot of dark shale and fire clay crops along the hill road slightly over a mile due south of May P. O. that appears to correlate with the Fish Creek coal, coming as it does at the base of a heavy sandstone and about 860 feet above the Pittsburgh coal bed.

The Rush Run Sandstone.

At 20 to 30 feet under the Fish Creek coal there occurs a persistent stratum in western Monongalia and northeastern Wetzel counties that has been designated the **Rush Run sandstone** by the writer[12] from a stream of that name near Hundred, Wetzel county, along which it crops and forms a prominent bluff. It was formerly correlated with the Fish Creek ledge, 20 to 30 feet higher in the measures, but was found to represent a separate and distinct ledge as will appear on pages 185-187 and 191-192 of the reference quoted in foot note No. 12.

In the Doddridge-Harrison area the crop of the Rush Run sandstone is confined to the hills in the Burchfield and Robinson synclines. In western Doddridge, the section given for Central Station, page 139, exhibits this stratum 15 feet in thickness, 272 feet above the Washington coal bed. In the eastern portion of the county, the Cascara section, page 137, gives this sandstone a thickness of 50 feet, 805 feet above the Pittsburgh coal bed. No quarries on it were seen in either county.

---

[12] Marshall-Wetzel-Tyler Rept., W. Va., Geol. Survey, pp. 191-192; 1909.

The Dunkard Coal.

From a few inches to 20 feet below the Rush Run sandstone in eastern Wetzel and western Monongalia counties there occurs a double bedded coal that has been designated the **Dunkard** by J. J. Stevenson from a stream of that name along which it crops in Greene county, Penna. There it comes 800 feet above the Pittsburgh coal bed, according to the log of the Frederick H. Hennen gas well, one mile west of Hero P. O.

This coal was noted at only one point in the Doddridge-Harrison area. The Cascara section, page 137, calls for one inch of this bed, 805 feet above the Pittsburgh coal. At several other points in the area it is represented by only a streak of fire clay at that horizon.

The Jollytown Sandstone.

In the 40 to 50 feet of measures that intervene between the Dunkard coal and the Jollytown bed next below there frequently occurs a massive sandstone at only 5 to 10 feet above the latter coal. This stratum has been designated by J. J. Stevenson[13] the **Jollytown sandstone** from its association with the coal of that name, in Fayette county, Pa. It has been more fully described near the type locality of the Jollytown coal by the writer on pages 196-197 of the Marshall-Wetzel-Tyler Report of the State Survey. On the pages mentioned of the latter report the writer erroneously assumed credit for naming this sandstone, and only just recently ascertained the mistake. It is worth mentioning, however, that Mr. Stevenson merely notes a sandstone overlying the Jollytown coal and does not name the formation in the text, but refers to it under that name in the index of the report only.

In the Doddridge-Harrison area its crop is confined largely to the hills and valleys of the Burchfield and Robinson structural basins. In northern Doddridge it is noted in both the Ashley and Big Battle sections, pages 136 and 74, where it has a thickness of 10 and 33 feet, respectively. It is also noted in the sections given for Central Station and Two Miles Southwest of Coldwater, pages 139 and 139, where it has a thickness of 20 and 40 feet, coming 215 and 240 feet above the base of the Washington coal, respectively. No quarries on it were observed in the area.

---

[13] Report KK, pp. 226-227, Sec. Geol. Survey of Pa.

The Jollytown Coal.

At 40 to 50 feet below the Dunkard coal in southwestern Pennsylvania and northern West Virginia, there occurs another bed that has been designated the **Jollytown coal** by J. J. Stevenson from its outcrop in a village of that name in Greene county, Penna.

In the Doddridge-Harrison area the crop of the coal is confined to practically the same region as outlined for the Jollytown sandstone. The writer measured the following section at an exposure of this bed on Middle fork of Little Tenmile creek, three-fourths mile northwest from Wallace:

		Feet.	Inches.
1.	Sandstone, shaly, Jollytown	8	0
2.	Shale, sandy	4	0
3.	Shale, dark........1' 0"	1	8
4.	Coal 0 8		
5.	Fire clay.		

There, according to the log of the L. E. Bartlett No. 1 well (342), it comes about 800 feet above the Pittsburgh coal bed, and, since the latter interval is slightly excessive, the coal of the section may possibly represent the Dunkard seam. It does not attain minable thickness within the area under discussion; hence, the bed has no economic value.

The Upper Washington Limestone, coming from a few inches to 5 feet under the Jollytown coal in western Monongalia and eastern Wetzel counties, and 2 to 5 feet in thickness, was not seen in the Doddridge-Harrison area, this limestone having apparently been replaced by sandy beds and shales.

The Hundred Sandstone.

At 10 to 15 feet under the Jollytown coal in eastern Wetzel county there occurs a massive sandstone, 25 to 30 feet thick, that has been quarried for building purposes 2 miles west from Hundred from which place it has been named the **Hundred** sandstone by the writer.[14].

The Hundred sandstone crops over most of the area of Doddridge and the western part of Harrison. In the section given for West Union, page 79, with the included reds it has a thickness of 35 feet, coming 175 feet above the Washington coal and 706 feet above the Pittsburgh bed. In southern Doddridge, the Grove and Two Miles Southwest of Coldwater sections, pages 84 and 139, give this stratum a thickness of 20 feet, 160 and 140 feet above the base of the Washington coal bed, respectively. There is some doubt, however, as to the correlation of this stratum in the latter section as mentioned therewith. No quarries in this stratum were seen in either county.

The Hundred coal disappears southwestward from Wetzel county, since no coal was observed at this horizon in the Doddridge-Harrison area.

The Upper Marietta Sandstone.

In the northern end of the State the interval between the Hundred sandstone and the Washington coal is nearly always occupied by two great sandstone ledges (Upper and Lower) that were named in early reports the Marietta sandstones from their occurrence near Marietta, Ohio, where they along with the Hundred sandstone have been quarried for grindstones[15].

In Doddridge county this rock is a very prominent topographic feature and forms escarpments around the hill sides over most of its area. It has a thickness ranging from

---

[14] Marshall-Wetzel-Tyler Rept., W. Va. Geol. Survey, pp. 214-215; 1909.

[15] Wirt-Roane-Calhoun Rept. W. Va. Geol. Survey, p. 131; 1911.

25 to 50 feet and occurs 100 to 125 feet above the base of the Washington coal bed. Its thickness and relative position to other strata in this county is exhibited in the sections for Sedalia, Numan, West Union, Glenwood, Grove, St. Clara, and Coldwater, published on preceding pages of this report. It is the stratum that forms the cliff on the head of Franks run of McElroy creek near the Chas. Edgell No. 1 well (57). There, according to D. B. Reger, it is 30 feet thick and its base has an elevation of 945 feet above tide. It also forms the cliffs 30 feet high along the public road, one mile and a quarter due north of Ashley P. O. In the southern edge of New Milton district, the Upper Marietta sandstone forms cliffs 50 feet high on the head of Brushy fork of Meathouse fork, one-half mile southwest from May P. O. There its base has an elevation of slightly over 1000 feet above tide.

The sandstone has been quarried for steps, chimneys, etc., for local supply on the north side of the public road, one-half mile east of Grove P. O., where its base has an elevation of slightly over 1100 feet above tide, and its thickness ranges from 40 to 50 feet.

In **Harrison county** the crop of the Upper Marietta sandstone is confined to a belt running northeast and southwest along the western flank of the Wolf Summit anticline, passing between Wallace and Brown on the W. Va. Short Line Branch of the B. & O. Railroad; and to another belt along the Harrison-Marion county line from Margaret P. O. eastward to near the longitude of Pine Bluff on Bingamon creek. The sections for Brown and Deweytown, pages 90 and 97, exhibit its thickness and relative position to other formations of the Dunkard series. At the latter place it is somewhat shaly, 44 feet in thickness and 115 feet above the base of the Washington coal.

The Washington "A" Coal.

From a few inches to 10 feet below the base of the Upper Marietta sandstone and 70 to 80 feet above the Washington coal there occurs a fairly persistent but very impure coal in the northern tier of counties of the State that has been designated the **Washington "A"**. I. C. White gives the following account of this bed on page 35 of Bulletin No. 65 of the U. S. Geological Survey:

> "At 70 to 80 feet above the Washington coal, there occurs a bed of impure coal and coaly shale which is often present in the section along Dunkard creek. Sometimes the entire bed is 4 to 5 feet thick, but little of it is ever merchantable coal, being seldom more than bituminous slate. It is well exposed in the hills about Blacksville and Brownsville, and there contains many bivalve crustaceans."

In the Doddridge-Harrison area the Washington "A" coal is nearly always represented by a thin streak of black slate, or more often fire clay shale, and at only one point in the two counties was actual coal observed at this horizon. This was along the public road on Leason run of Cabin run in western Doddridge, one mile due north of Joy P. O. There the Washington "A" is represented by 4 inches of slaty coal, and comes, according to the Greenwood section, page 80, for this region, 130 feet above the Washington bed.

The Creston Red Shale.

In Wirt, Roane and Calhoun counties 40 to 60 feet of dark red shales with limestone nuggets scattered throughout separate the Upper and Lower Marietta sandstones. The writer designated this formation the **Creston Red Shale** on page 154 of the detailed report of the latter counties from its fine development on the Creston Flats, one mile east from Creston, Wirt county.

In the Doddridge-Harrison area its thickness and relative position in the Marietta sandstone group are well exhibited in the sections for Sedalia, West Union, Greenwood, St. Clara and Deweytown on pages 70, 79, 80, 85, and 97, respectively. Frequently a massive sandstone, 20 to 30 feet in thickness, is included within the Creston shale as appears in the Greenwood section. There the writer has designated this stratum the **Middle Marietta sandstone** from its position between the Upper and Lower Marietta ledges. It is not generally persistent and for that reason has not been described under a separate heading. In western and southeastern Doddridge the Creston red shale is found cropping immediately below the Upper Marietta sandstone, and adds greatly to the fertility of the soil. In northern Harrison these reds are replaced more or less by sandy shales and thin sandstones.

The Middle Washington limestone of Stevenson[16] at 35 to 40 feet below the Washington "A" coal and 40 to 50 feet above the Washington coal, is not present in the Doddridge-Harrison area, it having apparently been replaced entirely by the Creston red shale, since nothing approaching a hard lime formation was observed at this horizon in either county.

The Lower Marietta Sandstone.

Immediately under the Middle Washington limestone and 2 to 5 feet over the Washington coal bed there occurs a massive arenaceous stratum that has been designated by the writer[17] the **Lower Marietta Sandstone.** Its relative position to the other formations of the Dunkard series at its type locality is exhibited in both the Steelton section, page 130, and the Marietta, Ohio, section on page 131 of the Wirt-Roane-Calhoun report of the State Survey. There it is a bluish gray, medium grained and micaceous sandstone, ranging from 20 to 30 feet in thickness.

Its thickness and position in the rock column in the Doddridge-Harrison area is exhibited in the sections for Sedalia, Numan, Greenwood, Kelly, St. Clara, Coldwater and Deweytown. The Lower Marietta sandstone forms cliffs and steep slopes immediately over the Washington coal bed wherever the latter crops in the two counties. It is this stratum that is the prominent cliff maker southeastward up Meathouse fork from New Milton, coming there immediately over the Washington coal which has been opened by the farmers at many points for domestic fuel.

The Lower Washington Limestone of Stevenson[18] is en-

---

16. Sec. Geol. Survey of Penna., Vol K, p. 49; 1875.
17. Marshall-Wetzel-Tyler Rept. W. Va. Geol. Survey, pp. 217-218; 1909.
18. Second Geol. Survey of Penna., Vol. K, p. 50; 1875.

tirely absent at all places where its horizon was observed at exposures in the Doddridge-Harrison area.

The Washington Coal.

The most persistent and most valuable from an economic standpoint of any bed in the Dunkard series is the Washington coal. I. C. White[19] first described this coal as a multiple bedded seam with the only pure coal in its basal portion.

In the Doddridge-Harrison area the Washington coal maintains the same characteristic features, in that the purest and best portion of the bed is at the bottom. It crops in the hills over a large portion of Doddridge and the western part of Harrison. This bed was used largely in the field as a key rock in determining the structure, and in the chapter on that subject, page 51, is given a table of oil and gas wells, exhibiting the interval in feet between the Washington and Pittsburgh coals. Hence, the crop of the Washington coal is outlined on the General and Economic Geology map accompanying this report and can be approximately determined where it occurs in the two counties by adding to the tidal elevation of the Pittsburgh coal bed the interval for that locality between the Washington and Pittsburgh coals.

Doddridge County.—In Doddridge the Washington coal has been opened by farmers and mined for local domestic fuel. It appears to be quite variable, thinning frequently to only a few inches of black slate, and again thickening up to 3 or 4 feet in a short distance. The rapid increase in the utilization of low grade coal in the gas producer form makes this bed quite an important economic resource for the area under discussion, since it is available at crop over a large portion of Doddridge county. Several sections and a few analyses will now be given, grouped largely by magisterial districts, exhibiting the thickness, character, and and quality of this coal.

Along the northwestern border of **McClellan district,** D. B. Reger measured the following section at an exposure of the Washington coal on the south bank of McElroy creek, one-fifth mile northeast from Eagle Mills, P. O.:

---

[19] Bulletin No. 65, p. 37, U. S. Geological Survey; 1891.

				Feet.	Inches.
Sandstone, gray, massive, Lower Marietta				20	0
Slate, black				1	3
Slate, gray				0	8
Coal, slaty	0′	4″	Washington	1	11
Slate, gray	1	3			
Coal, good	0	4			
Shale, yellow				7	0
Sandstone, yellow and shaly				8	0

(Elevation of coal is 760′ A. T., aneroid.)

In the same district, two miles eastward from Eagle Mills and one mile southwest of Ashley P. O., the following section of this coal was measured at the George Heirs opening on Riggins run:

	Feet.	Inches.
Slate, black	..	..
Coal, slaty	0	3
Slate, black	0	10
Coal, slaty	0	2
Slate, gray	0	5
Coal, good, 17″ to	1	10
Total:	3	6

(Elevation is 820′ A. T. by aneroid.)

The showing there is better than at Eagle Mills. About 3 miles northeast from the George Heirs opening, and 1.5 miles northwest from Centerpoint, D. B. Reger obtained the following section at an exposure of the Washington coal in the public road on Franks run near the Joseph Underwood No. 1 well (63):

			Feet.	Inches.
Slate, black			1	0
Coal, good	1′	2″		
Slate, black	1	6		
Slate, gray	0	6		
Coal, good	0	9 —	3	11
Fire clay shale, Washington			10	0
Concealed to Franks run			5	0

(Elevation of coal, 830′ A. T. by aneroid).

There the thickest and best portion comes at the top of the bed apparently, which is just the reverse of what usually happens for this coal seam.

At the northeast edge of Centerpoint the Washington coal was once opened, according to D. B. Reger, at an elevation of 884 feet above tide, spirit level measurement. The opening was abandoned, but the coal is reported 18 inches thick.

About 2½ miles northeast from Centerpoint the coal has been opened on the land of Josiah Davisson along a small branch of Talkington fork, one-fourth mile north of the Josiah Davisson No. 1 well (4). The coal mined there was utilized for fuel in a local school house, giving fair satisfaction. The opening had fallen shut when visited by the writer, but Mr. Davisson gives the following section for the bed at this mine:

	Feet.	Inches.
Coal, upper bench	1	6
Slate, dark gray	0	5
Coal, better	1	0
Total	2	11

(Elevation above tide, aneroid, 925').

In the northwestern portion of **Grant district**, Doddridge county, the following section was measured at an exposure of the Washington coal on the east side of Little Flint run at Canton P. O.:

			Feet.	Inches.
Sandstone, massive, Lower Marietta			..	..
Slate, black			1	3
Coal	0'	8 "		
Slate, gray	0	2½		
Coal	0	0½		
Slate, gray	0	2		
Coal, slaty	0	5		
Slate, gray	1	10		
Coal, slaty	0	6 —	3	10
Slate, gray, to run			1	0

(Elevation of coal, 805' A. T., spirit level).

The bed is quite slaty, and worthless.

Near the middle of the northeast boundary line of Grant district the writer obtained a sample for analysis and the following section at the J. D. Benedum mine in the Washington coal, located on the head of Righthand fork of Flint run, 1.5 miles east of Flint P. O.:

J. D. Benedum Mine, No. 1 on Map.

				Feet.	Inches.
1.	Concealed			..	..
2.	Coal, slaty	0'	1"		
3.	Shale, sandy	7	0		
4.	Slate, black	1	0		
5.	Coal, slaty	0	5		
6.	Slate, gray	0	3		
7.	Coal, good	1	1 —	9	10
8.	Fire clay, gray			1	6
9.	Concealed to run			2	0

(Elevation of coal, 965' A. T., aneroid).

The sample was collected from the bottom coal (No. 7) of section, the composition and calorific value of which are reported by Prof. Hite as follows:

Proximate Analysis.

	Percent.
Moisture	1.58
Volatile Matter	33.82
Fixed Carbon	51.83
Ash	12.77
Total	100.00
Sulphur	3.58
Phosphorus	0.011

Ultimate Analysis.

	Percent.
Carbon	68.83
Hydrogen	4.81
Oxygen	9.08
Nitrogen	1.00
Sulphur	3.51
Ash	12.77
Total	100.00

Colorimeter B. T. U. 12,488
Calculated B. T. U. 12,435

$$\text{Fuel ratio} = \frac{\text{Carbon.}}{\text{Oxygen} + \text{Ash}} = \frac{68.83}{9.08 + 12.77} = 3.15$$

The calorific value and fuel ratio agree closely with results obtained for the same bed in Roane county.

In the southern portion of Grant district, D. B. Reger obtained a sample for analysis and measured the following section at the R. M. Orr mine in the Washington coal, located on a branch of Buckeye run, one mile and a half due north of Long Run railroad station:

R. M. Orr Mine, No. 2 on Map.

				Feet.	Inches.
1.	Sandstone, shaly, Lower Marietta			10	0
2.	Slate, black			5	0
3.	Coal, good	0′	7″		
4.	Slate	0	1		
5.	Coal, good	1	2		
6.	Slate	1	8		
7.	Coal, good	1	0 —	4	6

"Sample from Nos. 3 and 5 of section. No. 7 was under water. Mine had fallen partially shut at mouth. Sample taken was about 20 feet under ground. Used for domestic fuel. Elevation of coal, 1015′ A. T. aneroid."

Prof. Hite reports the composition and calorific value of this sample as follows:

Proximate Analysis.

	Percent.
Moisture	1.66
Volatile Matter	34.36
Fixed Carbon	46.32
Ash	17.66
Total	100.00
Sulphur	2.50
Phosphorus	0.076

Ultimate Analysis.

	Percent.
Carbon	63.95
Hydrogen	4.53
Oxygen	10.25
Nitrogen	1.11
Sulphur	2.50
Ash	17.66
Total	100.00

Calorimeter B. T. U. 11,712
Calculated B. T. U. 11,418

$$\text{Fuel ratio} = \frac{\text{Carbon}}{\text{Oxygen} + \text{Ash}} = \frac{63.95}{10.25 + 1766} = 2.29$$

The above sample represents only the upper bench of this coal bed, since Mr. Reger was unable to get a sample from No. 7 of the section. The low B. T. U. result and fuel ratio as compared to that obtained for the lower bench at the J. D. Benedum mine, page 160, just about expresses the relative fuel values of the top and bottom portions of this coal.

In the extreme western part of **Greenbrier district** the writer measured the following section of the Washington coal at the fork of the second class road on Buffalo fork, 0.9 mile southeast from Long Run railroad station :

	Feet.	Inches.
Concealed and dark shale		
Coal, slaty	1	10
Slate, gray	0	3
Coal	1	2
Total	3	3

The coal has been opened by farmers at several points in Central district. It is the Washington bed that is mined where the Doddridge-Tyler county line crosses Mudlick run of Long run, one mile northwest from Orontes P. O. There its elevation is 845 feet above tide as determined with aneroid.

In the western corner of **Central district,** Mr. W. F. Ellifritt has opened the Washington coal at Greenwood and mined it under the hill a distance of 80 feet. He reports it 18 inches thick.

One mile and a quarter south of Greenwood, Chas. Caldwell has opened the Washington coal on Gum run of Cabin run near the William Flanagan No. 1 well (198) at an elevation of 855 feet above tide, aneroid. The opening had fallen shut, but Mr. Caldwell reports the following section:

	Feet.	Inches.
Coal, slaty	0	8
Slate, blue and gray	0	5
Coal	1	10
Total	2	11

He says the lower bench burns up well and leaves a fine white ash like wood. Another section of this bed was measured three-fourths mile southward in the edge of Ritchie and 1.5 miles northwest of Joy P. O. as follows:

	Feet.	Inches.
Coal, slaty	0	4
Shale, gray	0	1
Coal, good	1	1
Total	1	6

These sections illustrate how both benches vary in thickness within short distances.

About 6 miles farther southeastward in **Southwest dis-**

trict the Washington coal has been opened on the land of Morris Gaston, one-half mile north of Summers P. O. at an elevation of 1095 feet above tide, aneroid. There the mine had fallen shut, but the coal is reported nearly 4 feet thick.

The coal had been opened at several places by farmers for local domestic fuel in Cove district. It has about the usual thickness at the Haymond Lowther opening, three-fourths mile east from Grove. There the coal has an elevation of 980 feet above tide, spirit level. Two miles southeast of Grove on Rush run, the Washington coal is represented by 3 feet of **black slate.**

The Washington coal probably attains its best development for Doddridge county in **New Milton district.** The latter area is traversed in a northeast-southwest direction by the Robinson syncline, and this fold causes the coal to crop low in the hills over a large portion of New Milton, making it convenient for mining by the farmers. The following section was measured at an opening in this bed on the H. J. Bland farm, one mile and a quarter south, 5-10 degrees east from New Milton at the fork of the second class road, leading northeast from Meathouse fork of Middle Island creek:

			Feet.	Inches.
Fire clay shale			4	0
Slate, black			2	0
Coal, slaty	1'	1"		
Slate, black	2	6		
Coal, good	1	6 —	5	1
Fire clay shale.				
(Elevation, 865' A. T., hand level).				

The slate separating the two benches is thicker here than usual, being generally less than 1 foot.

In the northwestern portion of New Milton district the following section was measured at the W. R. Walton mine on a branch of Toms fork ¾ mile northwest from Market P. O.:

		Feet.	Inches.
Slate, black		2	0
Coal, slaty	1' 0"		
Slate, black	0 5		
Coal, slaty	1 2		
Slate, gray	0 3		
Coal, good, 12" to	1 6 —	4	4
Fire clay shale.			
(Elevation of coal, 930' A. T., aneroid).			

The bottom coal has a clean bright appearance.

D. B. Reger measured the following section at an exposure of the Washington coal in the road a short distance east from the mouth of Wolfpen run of Toms fork, one-half mile southeast from Market P. O.:

		Feet.	Inches.
Concealed			
Slate, black		1	0
Coal, slaty	1' 6"		
Shale, gray	0 6		
Coal, good	0 10 —	2	10
Shale, green		3	0
Shale, yellow		5	0
(Elevation of coal, 878' A. T., hand level).			

In the same district, nearly a mile southeast of Avon, the following section was measured at a mine on the east edge of the public road on Indian fork:

			Feet.	Inches.
Shale, sandy			6	0
Coal	0' 4"	Upper bench ...6' 8"		
Shale, dark, soft	4 10			
Coal	1 6			
Slate, gray		0 2		
Coal, good, lower bench		1 5 —	8	3
Slate, gray, and concealed				
(Elevation of coal, 975' A. T., aneroid).				

Here the middle slate of the upper bench of the W. R. Walton mine, page 163, has thickened from 5 inches to 4 feet 10 inches, giving the bed a total section of 8 feet 3 inches.

In the extreme southeastern corner of New Milton district samples of both benches were obtained for analysis, and the following section measured at a mine on the land of D. H. Nicholson, near the Nicholson No. 1 well (277) in which the Pittsburgh coal was encountered at a depth of 540 feet. The Washington coal crops 23 feet by hand-level above the well mouth, making the Washington-Pittsburgh coal interval 563 feet:

D. H. Nicholson Mine, No. 3 on Map.

				Feet.	Inches.
1.	Slate, black			2	0
2.	Coal	1′	4″		
3.	Slate, gray	0	1		
4.	Coal	1	5 —	2	10
5.	Fire clay			1	0
6.	Concealed to Nicholson well (277)			22	0

(Elevation of coal, 1040′ A. T., aneroid).

The samples were collected from Nos. 2 and 4 of the section. Their composition and calorific value are reported as follows by Prof. Hite:

Proximate Analysis.

	Upper Bench. Percent.	Lower Bench. Percent.	Average. Percent.
Moisture	1.69	1.44	1.56
Volatile Matter	36.48	36.96	36.72
Fixed Carbon	49.20	49.66	49.43
Ash	12.63	11.94	12.29
Total	100.00	100.00	100.00
Sulphur	3.95	3.64	3.795
Phosphorus	0.077	0.018	0.0475

Ultimate Analysis.

	Upper Bench. Percent.	Lower Bench. Percent.	Average. Percent.
Carbon	68.38	68.02	68.20
Hydrogen	4.68	4.67	4.68
Oxygen	9.39	10.75	10.07
Nitrogen	0.97	0.98	0.97
Sulphur	3.95	3.64	3.79
Ash	12.63	11.94	12.29
Totals	100.00	100.00	100.00

	Upper Bench.	Lower Bench.	Average.
Calorimeter B. T. U	12,485	12,542	12,513
Calculated B. T. U	12,282	12,105	12,194
Fuel ratio $= \frac{\text{Carbon}}{\text{Oxygen} + \text{Ash}} =$	3.10	3.00	3.05

At this opening the upper and lower benches are nearly on an equality, as is revealed by the calorimetric tests and the fuel ratio. In fact, the latter slightly favors the upper bench. This rarely happens with the Washington bed. Since the parting slate at this mine is only one inch in thickness, the coal could be worked to advantage as compared to other openings in the district. The results above given show this bed to be a valuable economic resource for the area.

Harrison County.—In Harrison, as mentioned on a preceding page, the crop of the Washington coal in confined to the western portion of the county, or rather to the belt on the western slope of the Wolf Summit anticline between the 425 and the 900-foot structure contours of the Pittsburgh coal as outlined on the General and Economic Geology map accompanying this report, crossing Eagle, Sardis, Tenmile and Union districts.

In the extreme northeast corner of **Eagle district** this coal crops at an elevation of about 1450 feet above tide. There it is about 3 feet thick and of fair quality. From there it dips rapidly westward along the slope of the Wolf Summit anticline, and passes under Bingamon creek a short distance east from Margaret P. O.

Along the northeast border of **Sardis district** the following section was measured at an exposure of the Washington coal along the public road on the head of Laurel run of Little Tenmile creek, 2 miles northeast from Brown:

			Feet.	Inches.
Concealed and shale			9	0
Coal, slaty	1'	6"		
Slate, gray	0	2		
Coal	0	6		
Shale, gray	0	8		
Coal	1	0 —	3	10
Fire clay shale			5	0

Elevation of coal, 1145' A. T., aneroid.

As in many portions of Doddridge, the upper bench carries a parting slate.

About two miles southwestward, and slightly over one mile northwest from Brown, the following section was measured at an exposure on Little Elk creek:

			Feet.	Inches.
Concealed				
Shale, dark			2	0
Coal, slaty	3′	0″		
Shale, dark	1	3		
Coal	0	4		
Shale, dark	1	6		
Coal, slaty	0	10		
Coal, slaty, better	2	0		
Shale, gray	0	9		
Coal, good	0	10 —	10	6
Fire clay shale to Little Elk creek			1	0

Elevation, 1005′ A. T., aneroid.

This section contains 7 feet of all kinds of coal, the greatest found for this bed in either county.

Along the northeast boundary line of **Tenmile district** and one mile southwest from Olive P. O., D. B. Reger reports the Washington coal 2 feet thick, slaty and having an elevation of 1145 feet above tide, aneroid. From there the bed dips rapidly westward to an elevation of about 1045 feet above tide slightly over one-half mile distant in the bed of a small branch of Grass run. At this place Mr. Reger reports it 3 feet thick and very slaty.

Near the central portion of Tenmile district the following section was measured at an exposure in the west portal of the Baltimore & Ohio Railroad tunnel, three fourths mile eastward from Bristol:

Bristol Section, Tenmile District.

			Feet.	Inches.
Sandstone, massive			15	0
Shale, sandy			4	0
Coal	0′	4″		
Slate, gray	0	1		
Coal	0	3		
Shale, gray	5	0		
Slate, coal streaks	4	0		
Coal, good	0	7		
Slate, black	0	3		
Coal, good	0	5		
Slate, gray	0	11		
Coal, good	0	6 —	12	4
Fire clay shale, Washington			11	0
Limestone, gray and hard, Bristol			4	0
Shale, limy to railroad grade			12	0

Elevation of coal, 1170′ A. T., aneroid.

The section contains only 25 inches of coal in a total of 148 inches. The section is noteworthy in that the 4 feet of limestone near the base has been designated the **Bristol limestone** by the writer from the nearby town.

A further discussion of the character, quality and probable available area of the Washington coal in the Doddridge-Harrison area will be given on subsequent pages of this report in the chapter on the coal resources.

The Washington Fire Clay Shale.

Immediately under the Washington coal in Wirt, Roane and Calhoun counties there occurs a yellowish green and impure fire clay shale that has been designated the **Washington Fire Clay Shale** by the writer from its association with the coal, on pages 163-164 of the detailed geologic report of that area. The following analysis is published therein from a sample of the fire clay shale collected in the town of Spencer, Roane county:

	Percent.
Silica ($Si\ 0_2$)	56.70
Ferric Iron (Fe_20_3)	2.18
Alumina (Al_20_3)	26.28
Lime ($Ca\ 0$)	1.04
Magnesia ($Mg\ 0$)	1.58
Potash (K_20)	3.01
Soda (Na_20)	0.40
Titanium ($Ti\ 0_2$)	0.78
Loss on ignition	8.62
Total	100.59

In the Doddridge-Harrison area this same fire clay shale accompanies the Washington coal wherever its crop is exposed, and it ranges from 5 to 10 feet in thickness. It is a great aid in finding the crop of the Washington coal, or the horizon of the latter bed when concealed by debris.

The Bristol Limestone.

At 10 to 15 feet below the Washington coal and immediately at the base of the Washington fire clay shale, there frequently occurs a limestone from 6 inches to 4 feet in thickness in Doddridge and Harrison counties. The Bristol section, page 167, exhibits this stratum 4 feet thick, 11 feet below the Washington coal. There it attains the best development observed in the area under discussion, and for that reason the writer has designated it the **Bristol Limestone.** On page 164 of the Wirt-Roane-Calhoun report of the State Survey, the writer mentions this limestone as occurring at the base of the Washington fire clay shale, with a thickness of 8 to 10 inches. G. P. Grimsley gives the following account of a limestone coming at this horizon in Ohio county on page 67 of the Ohio-Brooke-Hancock county report:

> "There appears to be a rather persistent limestone just below the Washington coal in Ohio county. This limestone is one to eight feet in thickness. In some sections it is under the coal, while in others it is separated by a few feet of shales. The rock is blue in color and usually hard and compact, but in one or two places it was nodular."

Hence, it follows that this stratum is a fairly persistent formation of the Dunkard series and is worthy of a distinctive name.

In the Doddridge-Harrison area this limestone rarely attains one foot in thickness, outside the region of Bristol. It has a buff color and very often a nodular and brecciated form. It is generally too thin and irregular to be considered an economic resource for the area.

The Washington Sandstone.

In southwestern Pennsylvania and in Marshall county, W. Va., there frequently occurs a flaggy sandstone, immediately under the Washington coal. I. C. White[20] gives the following account of this stratum:

> "Very frequently the Washington coal rests directly upon a flaggy sandstone, often finely laminated, brown, micaceous, and containing vegetable fragments in great quantity.
>
> "This stratum, which was called the Washington sandstone by Professor Stevenson, occurs over a wide area in Monongalia, Greene and Washington counties, but is not persistent very far south of the Pennsylvania line."

---

[20] Bulletin No. 65, page 38, U. S. G. Survey; 1891.

The Rosbys Rock, Marshall County, section[21] by the writer reveals this stratum only 6 feet in thickness, immediately at the base of the Washington fire clay shale; hence, the position given in the list of the known and described formations of the Dunkard series is most probably the true one.

In the Doddridge-Harrison area this sandstone is generally represented by sandy shales, 5 to 15 feet in thickness, immediately overlying the Mannington sandstone.

The Little Washington Coal.

At 10 to 20 feet under the Washington coal in southwestern Pennsylvania and in Ohio and Marshall counties, W. Va., there often occurs a thin coal bed that has been named by J. J. Stevenson from its association with the Washington bed above. The Rosbys Rock section, page 86 of the Marshall-Wetzel-Tyler report of the State Survey, places this bed 12 feet below the Washington coal and at the base of 5 feet of sandy shale that really belongs to the Washington sandstone. The coal was not observed at the many exposures of its horizon in the Doddridge-Harrison area, and does not seem to be represented in that region.

The Mannington Sandstone.

At 15 to 25 feet below the Washington coal and 5 to 10 feet below the Bristol limestone in several of the southwestern counties of West Virginia there occurs a great coarse, gray and brown, massive and frequently pebbly sandstone, ranging in thickness from 40 to 50 feet that has been designated by G. P. Grimsley[22] the Mannington sandstone from the town of that name in Marion county, this State, where it has been quarried for building purposes.

This stratum is a great cliff maker in central Tyler, Pleasants, Ritchie and Wood, along the eastern and western borders of Wirt, northern Calhoun and northeastern Roane counties.

---

[21] Marshall-Wetzel-Tyler Rept., W. Va, Geol- Survey, p- 86; 1909.

[22] W. Va. Geol. Survey, Vol. IV, page 440; 1906.

The sections given in Chapter IV of this report for Sedalia, Long Run, West Union, Greenwood, Summers, Cove and St. Clara for Doddridge county, and for Salem, South of Wolf Summit, and Benson for Harrison exhibit the thickness and character of the Mannington sandstone in the area under discussion. Wherever the Washington coal bed is elevated 70 to 80 feet above drainage, the whole of the Mannington sandstone is also above drainage, and most generally makes its presence known either in cliffs or very steep slopes around the hill sides. Its approximate crop in the two counties can readily be determined by observing the topography and crop of the Washington coal as outlined on the General and Economic Geology map accompanying this report.

The Waynesburg "B" Coal.

In Washington and Greene counties, Pa., and in Monongalia county, W.Va., there often occurs a thin coal, 40 to 50 feet below the Washington bed, that has been designated the **Waynesburg "B" coal.** In the Doddridge-Harrison area this stratum has apparently been cut away entirely in the deposition of the great Mannington sandstone.

The Waynesburg "A" Coal.

The Waynesburg "A" coal occurs 75 to 90 feet above the Waynesburg bed and represents the first coal above the base of the Dunkard series. In Vol. II. of the State Survey Reports, page 116, I. C. White gives the following account of this coal in northern West Virginia:

> "The only coal in this group[23] which is ever of any economic importance is the Waynesburg "A" bed, 80 to 90 feet below the Washington coal and the same interval above the Waynesburg, or base of the Dunkard series. This bed is quite generally present 10 to 15 feet above the Waynesburg sandstone through Monongalia, Marion, Harrison, Doddridge and Tyler counties and occasionally attains a thickness of 3½ feet. The coal contains much ash and other impurities, however, and makes only an indifferent fuel. It has been mined to a small extent in western Harrison and eastern Doddridge for local domestic use. Its presence is generally marked by a line of springs which came out of the ground on top of the impermeable clays and shales just below, and which, easily disintegrating, give origin to very bad roads with deep sticky mudholes along this line of outcrop."

---

[23] Referring to the Dunkard group or series.—RVH.

In the Doddridge-Harrison area, this coal occurs a few inches to 10 feet under the Mannington sandstone, and in Doddridge county, it rarely exceeds 6 inches in thickness, and quite frequently its horizon is represented by only a few inches of black shale.

Doddridge County.—The Waynesburg "A" coal crops over practically the same area of this county as that outlined above for the Mannington sandstone. Its crop is exposed at several places along McElroy creek in McClellan district, and at the M. A. Phillips No 1 well (69) is exposed in the road, one-half mile west of Centerpoint. There it is only 6 inches thick, coming 65 to 70 feet below the Washington bed, and 20 feet above the Phillips well (69). About 2½ miles northeast from Centerpoint, this coal crops in the road on Talkington fork at an elevation of 885 feet A. T. by aneroid. There it is only 6 inches thick. One mile southeast of the latter place, where its crop is exposed along the road on Sycamore fork of Pike fork of McElroy creek, the coal is only 4 inches thick.

Southwestward in the region of Alpha P. O. on Flint run, the Waynesburg "A" coal horizon is represented by a few inches of bituminous shale. One mile southwest of Knight P. O. and ¼ mile northeast from the D. L. Dotson No. 1 well (154), this shale is 10 inches thick, but contains no coal, its tidal elevation being 895 feet, spirit level.

On southwestward at Tollgate the following section was measured in the railroad cut at the southwest edge of the town

Tollgate Section.

	Thickness. Feet.	Total. Feet.
Coal, Washington, and concealed	20	20
Sandstone, massive, Mannington	40	60
Shale, yellow	1.5	61.5
Coal, Waynesburg "A" (6")	0.5	62
Fire clay and red shale	4	66
Sandstone, massive	4	70
Shale, red	10	80
Sandstone to B. & O. R. R. grade	2	82

Here the elevation of the Waynesburg "A" bed is about 820 feet A. T., aneroid.

Near the central portion of Doddridge and one-fourth mile northwest from New Milton, the following section was measured at an exposure of the horizon of the Waynesburg "A" coal along the public road

	Feet.	Inches.
1. Coal, Washington.		
2. Concealed and sandstone, massive, Mannington	62	0
3. Shale, sandy	3	0
4. Shale, red	5	0
5. Shale, dark (Waynesburg "A" coal horizon)	0	8
6. Fire clay.		
Elevation, 865′ A. T., aneroid.		

In the southern portion of the county, 2½ miles southeast of Grove P. O., the following section was measured at an exposure of the horizon of the Waynesburg "A" bed along the road on Rush run:

	Feet.	Inches.
Coal, Washington.		
Concealed	20	0
Sandstone, massive, Mannington	40	0
Shale, dark (Waynesburg "A" coal horizon).	0	4
Fire clay.		
Elevation of coal horizon, 895′ A. T., aneroid.		

In the southeastern portion of Doddridge, where the Waynesburg "A" coal crops along the road leading up Meathouse fork, one mile southeast from Avon P. O., it is only 2 inches thick, coming 70 feet under the Washington bed. At no point in Doddridge does this coal appear to attain sufficient thickness to have any commercial value.

Harrison County.—In Harrison county the Waynesburg "A" coal comes 60 to 70 feet under the Washington bed; hence, the area or region of its crop can readily be determined from the topography and the position of the crop of the Washington coal as outlined on the General and Economic Geology map accompanying this report. There it will be shown that its crop is confined to a narrow belt running northeast and southwest across the county via. Grangeville, Brown, Lynch, Deweytown and Benson. At one mile northeast of the latter point its crop is exposed along the hill road, where it is only

6 inches thick at an elevation of 1155 feet above tide, aneroid.

Northward on a branch of Little Rockcamp run, one mile and a half northwest from Olive P. O., the Waynesburg "A" coal crops in the public road, with a thickness of 10 inches. Northward to the Marion county line the bed thickens up somewhat, and on Laurel run, one mile and a half northeast of Brown, it is 18 inches thick. One mile and a half farther northeast at the triangle of roads on Jones creek, it has a thickness of 18 inches, its tidal elevation being 1110 feet, aneroid A short distance, less than one mile, northwest, the bed is less than 1 foot thick and quite slaty. While this coal makes a better showing in Harrison than in Doddridge, yet it does not attain sufficient thickness and regularity in either to be considered an economic resource for the area.

The Mount Morris Limestone.

At 1 to 5 feet under the Waynesburg "A" coal bed in Greene county, Penna., and in Marshall county, W. Va., there often occurs from 6 inches to 3 feet of limestone that has been designated the **Mount Morris Limestone** by I. C. White[24] from a town of that name in Greene county, Penna. This stratum has apparently been replaced by sandy shales in the Doddridge-Harrison area, since it was not recognized at any point in either county.

The Waynesburg Sandstone.

At 1 to 10 feet above the base of the Dunkard series and 15 to 20 feet below the Waynesburg "A" coal, there occurs a great massive sandstone that has been designated by the First Geological Survey of Pennsylvania the **Waynesburg sandstone** from a town of that name in Greene county, Penna., near which it has a fine development. I. C. White gives the following account of this stratum on page 40 of Bulletin No. 65 of the U. S. G. Survey.:

---

[24] Bulletin No. 65, U. S. G. Survey, pages 39-40; 1891.

"It is one of the most persistent members of the Permo-Carboniferous series, since its eastern outcrop can be followed in an almost continuous line of cliffs from Greene county, Penna., clear across West Virginia to the Big Kanawha river at Winfield."

"This stratum is the only one of the series[25] that is generally conglomeratic or contains quartz pebbles larger than coarse sand grains. On account of this peculiarity, the rock in question becomes a very important guide to the geologist in the interior of West Virginia, where so many of the Dunkard coals and limestones have disappeared, for its retains its pebbly character over a very wide area. When at its greatest development, the thickness of this stratum approaches 75 to 100 feet. It is usually a grayish white rock, with a yellowish cast on freshly broken surfaces, and its weathered boulders are usually covered with ridges and streaks of harder iron-bearing sand. The rock splits readily and frequently furnishes excellent building stone, the piers of the Baltimore & Ohio R. R. bridge across the Monongahela river near Fairmont having been constructed of it."

Since the publication of Bulletin No. 65 in 1891, a more detailed study of the sandstones of the Dunkard series in West Virginia by the writer reveals the fact that the Lower Marietta and Mannington ledges are frequently quite conglomeratic in Wirt, Roane and Calhoun counties, the quartz pebbles therein frequently attaining one-half inch in diameter.

In the Doddridge-Harrison area, the crop of the Waynesburg sandstone is very closely exhibited by the boundary line between the Dunkard and Monongahela series as outlined on the General and Economic Geology map accompanying this report. It does not appear so massive as in some portions of the State, since, in these counties it is quite frequently broken up into sandy beds and red shales. The sections given on preceding pages of this report for Sedalia, Long Run, Summers, Kelly, Grove, Big Isaac and Brown exhibit its thickness, character and relative position in the rock column.

At the east edge of Brown, Harrison county, this stratum has recently been quarried to furnish piers for the public highway bridge over Little Tenmile creek at that place. There it is gray, coarse, slightly pebbly and 25 to 35 feet thick. Northeastward along Laurel run from Brown the Waynesburg sandstone forms cliffs and steep slopes 2 to 5 feet over the Waynesburg coal bed.

---

[25] Referring to the Dunkard series.—RVH.

The Elm Grove Limestone.

At 5 to 10 feet above the Waynesburg coal in Wetzel, Marshall and Ohio counties, W. Va., there often occurs from 1 to 5 feet of dark, flaggy limestone that has been designated by G. P. Grimsley[26] the **Elm Grove limestone** from a town of that name near which it crops in Ohio county referred to above. In the Doddridge-Harrison area this stratum has apparently thinned away entirely, since no limestone was observed at this horizon at the numerous exposures in the two counties.

The Cassville Plant Shale.

The first and lowest member of the Dunkard group of rocks is the **Cassville Plant Shale** that has been so designated by Wm. M. Fontaine and I. C. White from a town of that name in Monongalia county, W. Va., near which it crops. There it ranges from 0 to 20 feet in thickness and contains a rich insect fauna as well as flora.

In the Doddridge-Harrison area this shale is not generally well defined or easily recognized, since over most of the area of the two counties the Waynesburg coal bed at the top of the Monongehela series is absent from the measures. The latter coal is present, however, in the sections for Big Isaac and Salem, pages 89 and 95, and at the former place the shale is 5 feet thick and quite sandy. The Brown section, page 90, reveals the Waynesburg sandstone in direct contact with Waynesburg coal, the former there having cut away the Cassville shale entirely. Northeastward on Laurel run, however, the shale is 2 to 5 feet thick.

---

[26] Ohio-Brooke-Hancock Rept., W. Va. Geol. Survey, page 68; 1906.

AGE OF THE DUNKARD SERIES.

There has been much discussion both by American and European geologists as to the age of the Dunkard series as revealed by the fossil fauna and flora. On pages 69-77 of the Ohio-Brooke-Hancock Report of the W. Va. Geol. Survey, G. P. Grimsley gives a very interesting account as to the age of the Dunkard rocks as discussed by geologists in other publications. From all the evidence yet collected, this series apparently belongs to the lower Permian of Europe.

CHAPTER VI.

THE MONONGAHELA SERIES

The Monongahela series is that division of the rock column which begins at base with the bottom of the Pittsburgh coal bed and extends up to the base of the Cassville Plant shale or to the top of the Waynesburg coal. This group of rocks was so designated by H. D. Rogers from the river of that name in Pennsylvania, along which its coal beds attain a fine development. In West Virginia the thickness of the series ranges from 260 feet in Ohio and Marshall counties along the Ohio river, to over 435 feet in southeastern Doddridge and southwestern Harrison. By far the greater portion of the series is limestone in southwestern Pennsylvania and the border counties of West Virginia, but southward in Doddridge and Harrison, several massive sandstones make their appearance and limestone decreases. The reader is referred to pages 124-125 of Vol. II. of the State Survey reports for a more detailed description of these beds in other portions of the State.

The writer has compiled the following general section of the Monongahela series from a large number of detailed sections of these measures as published in the State Geological reports. As the series was first studied in Pennsylvania the most of the names are taken from localities in that State. Later names to be added from West Virginia are Gilboy and Arnoldsburg sandstones and Benwood limestone:

General Section of the Monongahela Series for West Virginia.

	Thickness. Feet.	Total. Feet.	
Coal, Waynesburg	5	5	
Shale	10	15	
Sandstone, Gilboy	35	50	
Coal, Little Waynesburg	1	51	51′
Limestone, Waynesburg	4	55	
Shale	13	68	
Sandstone, Uniontown	35	103	
Coal, Uniontown	2	105	54′
Shale	10	115	
Limestone, Uniontown	15	130	
Shale, with thin sandstones and limestones	44	174	
Sandstone, Arnoldsburg	30	204	
Coal, Lower Uniontown	1	205	100′
Shale	5	210	
Limestone, Benwood	65	275	
Sandstone, Sewickley	25	300	
Coal, Sewickley	5	305	100′
Sandstone, Lower Sewickley	25	330	
Limestone, Sewickley	43	373	
Coal, Redstone	4	377	72′
Limestone, Redstone	5	382	
Sandstone, Upper Pittsburgh	15	397	
Shale, limy	5	402	
Coal, Pittsburgh	8	410	33′

In the area under discussion the Monongahela series is brought above drainage by the Arches Fork, Wolf Summit, and Chestnut Ridge anticlines. The detailed crop of these rocks is outlined on the General and Economic Geology map accompanying this report.

Several sections of the Monongahela series are given in Chapter IV of this report on the pages as indicated in the table summarizing the sections at the end of that chapter. In addition several scattered sections of these measures will now be given.

The following section was measured with aneroid from the summit of a high knob, one mile due north of Shinnston, northwestward along the hill road to Bingamon creek at Pine Bluff P. O. The intervals and totals are slightly less than they should be for the reason that the top formation of the section has risen about 25 feet in this direction before the

Pittsburgh coal is reached. The aneroid measurements were checked on spirit level elevations at both the top and foot of the hill:

Pine Bluff Section, Clay District.

	Thickness. Feet.	Total. Feet.	
Dunkard Series (54')			
Concealed from top of knob at M. Tegard No. 1 well (606)	20	20	
Fire clay and shale	5	25	
Sandstone, coarse, massive	29	54	54'
Monongahela Series (378')			
Coal blossom, Waynesburg (1320' B-A. T.)	1	55	
Concealed and shale	10	65	
Sandstone, massive, coarse brown and pebbly, Gilboy	40	105	
Concealed	5	110	
Shale, red	5	115	
Concealed with red shale	64	179	
Limestone, Uniontown	1	180	
Shale and sandstone, flaggy	10	190	
Concealed	15	205	
Sandstone, shaly	15	220	
Concealed to upper limit of old river terrace	60	280	
(Elevation, upper limit, 1090' B-A. T.)			
Concealed (old terrace debris)	55	335	281'
Sandstone	15	350	
Concealed } Lower Sewickley	10	360	
Sandstone	8	368	
Shale, limy and gray	8	376	
Limestone, gray and hard, Sewickley	4	380	
Shale, gray and limy	6	386	
Concealed	7	393	60'
Shale, coaly (Redstone)	2	395	
Shale, gray and limy	5	400	
Concealed to Bingamon creek at Pine Bluff	24	424	37'
Coal, Pittsburgh	8	432	

Adding a correction of 25 feet for dip to the 378 feet gives the Monongahela rocks a total of 403 feet.

The record of a diamond drill boring 5 miles northeastward, published on pages 676-677 of Vol. II(A) of the State Survey reports, gives the same measurements 419' 10".

The following section was measured partly along the hill road leading northeast to Shinns run, one-half mile below Saltwell P. O.:

Section Two Miles East of Gypsy, Clay District.

	Thickness. Feet.	Total. Feet.	
Dunkard Series (200')			
Concealed from summit of high knob 1.5 miles southeast from Gypsy	200	200	200'
Monongahela Series 365')			
Concealed to road at low gap, east of Gypsy.	100	300	
Concealed along road	35	335	
Sandstone, flaggy, Arnoldsburg	25	360	160'
Concealed and sandstone, massive	35	395	
Concealed	15	410	
Limestone, white, Benwood	5	415	
Concealed and shale	20	435	
Sandstone, massive, Upper Sewickley	14	449	89'
Fire clay (Sewickley coal horizon)	1	450	
Shale	5	455	
Sandstone, massive, Lower Sewickley	35	490	
Shale	19	509	
Fire clay	1	510	
Shale, limy top, sandy bottom	47	557	
Coal, Pittsburgh	8	565	116'
Conemaugh Series (41')			
Concealed and sandstone, massive, Lower Pittsburgh	40	605	
Coal blossom, Little Pittsburgh	1	606	41'

A correction of 50 feet will have to be added to the total 365' for the Monongahela series on account of the westward dip of the strata, giving the latter a thickness of 415 feet. The limestones of the northern end of the State have been replaced largely by sandy shales and massive sandstones. The Sewickley and Redstone coals have thinned away entirely in this portion of Harrison county.

The following section was measured with hand level along the point just northeast of Gore station on the Fairmont and Clarksburg electric railroad, 2 miles due north of Clarksburg:

Section at Gore Station, Coal District.

	Thickness. Feet.	Total. Feet.	
Monongahela Series (149.5')			
Sandstone, flaggy, Upper Sewickley	10	10	
Shale	10	20	
Coal, Sewickley	1.5	21.5	21.5'
Fire clay and shale	10	31.5	

		Thickness. Feet.	Total. Feet.	
Sandstone, buff, fine grained, massive, Lower Sewickley		26	57.5	
Concealed		84	141.5	
Coal, Pittsburgh		8	149.5	128′
Conemaugh Series (64.5′)				
Fire clay and concealed		32	181.5	
Sandstone, massive, limy, Lower Pittsburgh		10	191.5	
Shale, gray		4	195.5	
Limestone, gray and hard, Pittsburgh		0.5	196	
Fire clay shale (Little Pittsburgh coal horizon)		3.5	199.5	50′
Limestone, bluish gray	Lower Pittsburgh.	7	206.5	
Shale, gray and limy		3	209.5	
Limestone, bluish, silicious, lentil		1.5	211	
Shale, red, to B. & O. R. R. grade		3	214	14.5′

The section is interesting in that details are given not only of the Monongahela, but of the top portion of the Conemaugh series as well.

The following section of the Monongahela series was measured by J. L. Johnston, C. E., along the face of Pinnickinnick hill at the north edge of Clarksburg, and published on page 49 of Bulletin No. 65 of the U. S. G. Survey:

Clarksburg Section.

	Ft.	In.	Feet.	Inches.
Coal, Waynesburg? (Uniontown), absent or not seen			0	0
Concealed and yellow sandy shales	65	9		
Sandstone, (Arnoldsburg)	25	0		
Concealed, with some limestone	80	0		
Sandstone	20	0		
Concealed	5	0		
Sandstone	15	0		
Sandy shales	6	0		
Sandstone, Sewickley	25	0		
Shales	10	0—	251	0
Coal, Sewickley			1	0
Limestone... shaly....1′ 6″ good.....7 6	9	0		
Concealed	3	0		
Shales, sandy	14	0		
Shale, with iron nodules	1	0		
Shales, sandy	4	0		
Sandstone	1	0		
Concealed	8	0—	40	0
Coal, Redstone, slaty			3	0

			Feet.	Inches.
Shale, dark, bituminous	5	0		
Limestone, Redstone	6	0		
Shale, greenish	13	0		
Slate, bituminous	1	0—	25	0
Coal,' Pittsburgh { coal	3	5		
Coal,' Pittsburgh { bone	0	1		
Coal,' Pittsburgh { coal	5	0—	8	6
Total			328	6

The identifications in parentheses are by the writer. The Monongahela measures should be 410 to 420 feet thick here; hence, Mr. Johnston's section lacked 80 to 90 feet of reaching up to the base of the Dunkard series.

The following section was measured mostly along the hill road southwestward to Stutler fork nearly along the strike of the rocks:

Section One Mile North of Mineral, Union District.

	Thickness. Feet.	Total. Feet.	
Dunkard Series (215')			
Concealed and shale from top of knob	115	115	
Sandstone, massive, buff, coarse and pebbly, forming cliffs and large boulders, Mannington	40	155	
Concealed to road at low gap	60	215	215'
Monongahela Series (383')			
Shale, red	10	225	
Sandstone, cliff rock, Gilboy and Uniontown	100	325	110'
Concealed	30	355	
Shale, red	20	375	
Limestone, modular, shaly	15	390	
Shale, red	24.7	414.7	
Shale, black (4"), (Lower Uniontown coal horizon)	0.3	415	90'
Shale, dark red and limy	35	450	
Sandstone, massive, coarse brown, Upper Sewickley	38	488	
Fire clay (Sewickley coal horizon) (1045' B-A. T.)	2	490	75'
Interval, estimated	100	590	
Coal, Pittsburgh	8	598	108'

DESCRIPTION OF THE MONONGAHELA FORMATIONS.

The Waynesburg Coal.

The highest formation of the Monongahela series is the Waynesburg coal. It correlates with the No. 11 seam in the former nomenclature of the Ohio coals, and attains its best West Virginia development in Monongalia and Marion counties. It is always multiple bedded, being separated into benches, upper and lower, by a shale parting 1 to 15 inches thick, the whole often attaining a thickness of 10 to 12 feet.

In the Doddridge-Harrison area the coal rarely exceeds 2 feet in thickness and does not appear merchantable at any point in the county. The crop of the bed is outlined in detail on the General and Economic Geology map accompanying this report.

Doddridge County.—In Doddridge county the coal has thinned away entirely except in the extreme eastern point of Greenbrier district. Where its horizon first comes above the level of Meathouse fork, at the road fork, one mile and a quarter west of Big Isaac, the bed is represented by only 3 inches of slaty coal. One-half mile farther east it has thickened up to 4 inches. One mile southeastward and one-half mile southwest from Big Isaac, the following section is exposed at the crop of this bed:

				Feet.	Inches.
Sandstone, Waynesburg					
Shale, sandy, Cassville				5	0
Coal, slaty	0'	4"	Waynesburg	1	1
Slate, gray	0	6			
Coal, slaty	0	1			
Slate, gray and yellow	0	1			
Coal, slaty	0	1			
Fire clay				5	0

(Elevation of coal, 1055' B-A. T.)

In the northern portion of Doddridge the log of the Hudson diamond drill boring (21), used in connection with the Sedalia section, page 70, gives only 2 feet of **black and gray shale** at this horizon, 136 feet below the Washington coal and 381.5 feet above the Pittsburgh seam.

Harrison County.—In Harrison the Waynesburg coal attains a better development than in Doddridge. The log of the I. L. Marsh No. 1 well (373), used in connection with the section at Brown, page 90, reports the bed 3 feet thick. The coal crops near the bed of Laurel run, one-half mile northeast from Brown where the following section was measured:

	Feet.	Inches.
Coal	1	0
Slate, gray	0	1
Coal	1	0
Total	2	1

(Elevation, 1030′ B-A. T.)

Here the structure of the bed is similar to that for the northern portion of the State, in that it carries a parting slate, separating it into two benches.

The following section of the Waynesburg coal was measured near run level of a branch of Little Rockcamp, one mile and a quarter northwest from Olive P. O.:

			Feet.	Inches.
Sandstone, massive, Waynesburg				
Shale, dark, Cassville, 3′ to			5	0
Coal	0′	8″	1	11½
Slate, gray and soft	0	0½		
Coal	1	3		
Fire clay				

(Elevation of coal, 1030′ B-A. T.)

In the Pine Bluff section, page 180, this coal is given a thickness of 1 foot, but there the bottom portion of the bed was concealed.

The seam is seldom reported in the logs of the numerous wells drilled for oil and gas in both counties.

The Gilboy Sandstone.

At 5 to 10 feet below the Waynesburg coal there often occurs a massive sandstone, ranging in thickness from 20 to 40 feet, that has been designated the Gilboy by I. C. White[1] from a railroad cut of that name, located a short distance east from Mannington, Marion county.

In the Doddridge-Harrison area this sandstone frequently makes cliffs or steep slopes around the hillsides just below the horizon of the Waynesburg coal. The relative position of this stratum to the other formations, its character and thickness are exhibited in the sections given on preceding pages for Sedalia, Centerpoint, Long Run, Brown, Katys Lick, Salem and Wolf Summit.

One-fourth mile northeast of Brown at the mouth of Laurel run, the Gilboy makes a cliff 20 to 25 feet high. No quarries in this stratum were seen in either county.

The Little Waynesburg coal and the **Waynesburg limestone** disappear southwestward from Marion county and neither was observed at exposures of its horizon in the Doddridge-Harrison area.

The Uniontown Sandstone.

At 10 to 20 feet below the Gilboy sandstone and 60 to 75 feet below the Waynesburg coal there occurs another bluish gray, brown and massive sandstone that has been named the **Uniontown** from its relation to the underlying coal by I. C. White[2].

In the Doddridge-Harrison area this stratum forms cliffs and steep slopes around the hill sides over a large portion of both counties. The sections given for Sedalia, Long Run, West Union, Greenwood, Summers, Kelly, Katys Lick, South of Wolf Summit, and Mineral, exhibit its thickness, character and relative position in the rock column in the area under discussion.

In **Doddridge county** it is this sandstone that forms the prominent cliffs along the Baltimore & Ohio railroad between Long Run and West Union, where it is coarse, gray and brown, and frequently pebbly, coming immediately over the Uniontown coal and 300 to 310 feet above the Pittsburgh bed.

---

[1] Vol. II, p. 150, W. Va. Geol. Survey; 1903.
[2] Bulletin No. 65, pp. 58 and 59, U. S. G. Survey; 1891.

Along the extreme western border of New Milton district the Uniontown has been quarried for building purposes on the head of Lick run, 3 miles due west from Market. Here, according to D. B. Reger, it is 50 feet thick, coarse and soft, coming 155 feet under the Washington coal.

In **Harrison county** it crops in a prominent cliff along the railroad grade, one-half mile southeast from Brown, where it is bluish gray in color and 35 to 40 feet thick. No quarries were observed in this stratum in the latter county, although G. P. Grimsley[3] reports the T. M. Jackson quarry at Clarksburg as belonging at this horizon. There the interval from the base of the quarry rock to the base of the Pittsburgh coal—238 feet—is 60 to 70 feet too short for the former stratum to represent the Uniontown sandstone. It probably correlates with the Arnoldsburg, since the latter attains a good development in the area under discussion.

In the southwest corner of Harrison the Uniontown sandstone makes high cliffs north and northwest from Mineral on the head of Two Lick run and along Stutler fork.

The Uniontown Coal.

At 1 to 10 feet below the Uniontown sandstone and 90 to 110 feet below the Waynesburg coal there occurs a fairly persistent bed that has been designated by the First Geological Survey of Pennsylvania the **Uniontown coal** from a town in the latter State near which it crops. It rarely exceeds 3 feet in thickness in West Virginia, and often is represented by only a few inches of black slate. In the Doddridge-Harrison area its thickness and relative position in the rock column is exhibited in the sections given on preceding pages for Sedalia, Centerpoint, Canton, Long Run, West Union, Brown, Salem and Benson.

---

[3] Vol. IV, pp. 455-457, W. Va. Geol. Survey; 1909.

Doddridge County.—In Doddridge this coal is brought above drainage by the Arches Fork anticline along the waters of Middle Island creek above West Union; Left fork of Arnolds creek; South fork of Hughes river above Nay P. O.; Middle fork of Hughes river above Holbrook; and Cove and Fink Creeks in the southern portion of the county. It is this bed that has been mined by farmers 5 to 100 feet above stream level along the Baltimore & Ohio railroad between Long Run and West Union, where it furnishes a fair quality of domestic fuel, and, including partings, ranges from 2 to 3 feet thick.

The following section of the coal was measured at the J. M. Gribble mine on the south bank of Bluestone, one-half mile southeast of West Union:

				Feet.	Inches.
1.	Sandstone, massive, Uniontown				
2.	Shale, sandy, 6′ to			8	0
3.	Coal, slaty	0′	3″		
4.	Coal, good	2	8½		
5.	Slate, soft and dark	0	4		
6.	Coal, good, 4″ to	0	6 —	3	9½
7.	Fire clay				

(Elevation of coal, 814′ A. T., spirit level).

Nos. 4 and 6 of the section have a clean, bright appearance and should furnish a fair quality of domestic fuel.

From here the bed dips rapidly westward and passes below Middle Island creek at the public highway bridge over this stream in West Union. Eastward the coal has been mined considerably by farmers on Jockeycamp, Englands and Morgans runs, and Buckeye creek. D. B. Reger reports it about 2 feet thick at an elevation of 890′ B-A. T. on Englands run, 1.5 miles northeast of Smithton.

Near the Grant-West Union district line, one-third mile northwest of Morgansville, D. B. Reger measured the following section at a mine in the Uniontown coal:

			Feet.	Inches.
Slate			4	0
Coal, good	1′	6″		
Slate	0	6		
Coal, good	1	0 —	3	0

(Elevation, 915′ A. T., aneroid).

Slightly over a mile southeastward Mr. Reger collected a sample for analysis and measured the following section at the W. A. Stutler mine in the Uniontown coal, located near Sherwood, one-tenth mile north of the mouth of Long Run:

W. A. Stutler Mine, No. 4 on Map.

			Feet.	Inches.
1.	Sandstone, visible, Uniontown			
2.	Shale, brown		13	0
3.	Coal, good	1′ 0″		
4.	Slate	0 4		
5.	Coal, good	1 4 —	2	8

(Elevation, 855′ A. T., spirit level).

The sample for analysis was collected from Nos. 3 and 5 of the section, the composition and calorific value of which are reported by Prof. Hite as follows:

Proximate Analysis.

	Per cent.
Moisture	1.67
Volatile Matter	38.73
Fixed Carbon	45.27
Ash	14.33
Total	100.00
Sulphur	4.77
Phosphorus	0.041

Ultimate Analysis.

	Per cent.
Carbon	66.79
Hydrogen	4.80
Oxygen	8.39
Nitrogen	0.92
Sulphur	4.77
Ash	14.33
Total	100.00

Calorimeter B. T. U. 12,349
Calculated B. T. U. 12,239

$$\text{Fuel ratio} = \frac{\text{Carbon.}}{\text{Oxygen} + \text{Ash}} = \frac{66.79}{8.39 + 14.33} = 2.94$$

These results show the coal to be nearly of the same character and quality as the Washington bed, 200 to 220 feet higher in the measures.

South 10° to 20° west from West Union, Mr. Reger obtained a sample for analysis and measured the following section at the Alfred Collins mine in the Uniontown coal on Left fork of Arnolds creek:

Alfred Collins Mine, No. 5 on Map.

			Feet.	Inches.
1.	Sandstone, shaly, Uniontown		3	0
2.	Shale, gray		3	0
3.	Slate, black		1	0
4.	Coal, good	1′ 6″		
5.	Slate, gray	0 2		
6.	Coal, slaty	0 10 —	2	6
7.	Shale, yellow		2	0
8.	Concealed		10	0
9.	Sandstone, flaggy		6	0

(Elevation of coal, 905′ A. T., aneroid).

Mr. Reger collected the sample from No. 4 only, the composition and calorific value of which are reported by Prof Hite as follows:

Proximate Analysis.

	Per cent.
Moisture	1.60
Volatile Matter	39.99
Fixed Carbon	45.31
Ash	13.10
Total	100.00
Sulphur	4.65
Phosphorus	0.040

Ultimate Analysis.

	Per cent.
Carbon	67.59
Hydrogen	4.65
Oxygen	9.02
Nitrogen	0.99
Sulphur	4.65
Ash	13.10
Total	100.00

Calorimeter B. T. U. 12,464

Calculated B. T. U. 12,208

$$\text{Fuel ratio} = \frac{\text{Carbon.}}{\text{Oxygen} + \text{Ash}} = \frac{67.59}{9.02 + 13.10} = 3.06$$

The results show a slightly higher grade of fuel than that represented by the sample from the Stutler mine. The latter, however, included both benches of the Uniontown, while the Collins sample represents the upper bench only. It is worthy of notice that the latter coal generally reverses the conditions accompanying the Washington bed, in that the purest and best coal occurs in the upper bench.

About 6 miles southwestward the Uniontown coal was once mined near the mouth of Sheep run, 0.8 mile east from Nay P. O. The opening had fallen shut, but the bed was reported 18 inches thick.

About 2 miles northeast from Summers P. O., the coal crops close stream level near the Eli M. Gaston No. 1 well (212) on Upper run, where it is only 6 inches thick at an elevation of 935′ A. T., aneroid.

It has the same thickness where its crop is exposed at the road forks near the head of Bluestone creek, two miles and a half due north of Kelly P. O. The bed apparently thins to less than one foot in southern Doddridge. In fact, near the extreme southern point of the county, 0.1 mile northeast of the month of Sycamore fork, the coal is only 2 inches thick, at an elevation of 825′ A. T., aneroid.

Harrison County.—In Harrison the Uniontown coal is not so thick apparently as at West Union and Sherwood. Its crop is confined to a belt running northeast and southwest across the county 2 to 3 miles wide, the western margin of which is one-half mile southeast of Grangeville; one-half mile southeast of Brown; three-fourths mile northwest of Marshville; one-half mile west of Lynch; at Deweytown; and near Benson at the Harrison-Lewis county line. Its horizon also crops in the hills in the northern portion of Eagle district, and the northwestern part of Clay, around the nose of the Wolf Summit anticline; and southward along the axis of the Shinnston syncline to the vicinity of Lost creek. The high knobs on the Harrison-Upshur county line, 2 miles eastward from Johnstown, probably hold near their summits a few acres of this bed.

On the north border of Eagle district, the following section was measured at an opening in what appears to be the Uniontown coal, three-fourths mile southeast of Grangeville, near the B. F. Griffin No. 1 well (551):

			Feet.	Inches.
Sandstone, massive, visible			10	0
Shale, buff, sandy			4	0
Coal, slaty, 0″ to	0′	2″		
Shale, dark, soft	1	3		
Coal	0	9		
Shale, gray	0	4		
Coal	1	1 —	3	7
Fire clay and concealed to run			10	0

(Elevation of coal, 1010′ A. T., aneroid).

Southwestward on Little Tenmile, the coal rises above stream level, one-half mile southeast of Brown, and near there the following section was measured on the south side of the railroad:

			Feet.	Inches.
Shale			5	0
Coal	0'	3"		
Shale, dark	0	4		
Coal	0	4		
Shale, dark	3	0		
Coal	0	4 —	4	3
Fire clay			5	0

(Elevation of coal, 995' A. T., aneroid).

Although the bed has a total section of 51 inches, yet it contains only 11 inches of coal. Four miles southwestward on Grass run and three-fourths mile northwest of Marshville, the blossom of this coal crops in the road at an elevation of 1010' A. T., aneroid.

In the southern part of Tenmile district the following section was measured at an exposure of the Uniontown coal at Deweytown along the edge of the public road:

			Feet.	Inches.
Sandstone, massive, Uniontown				
Shale			0	4
Black slate	0'	4"		
Slate, gray	0	1		
Coal	0	4 —	0	9

(Elevation of coal, 1065' A. T., aneroid).

In the northwestern part of Union district the Uniontown coal crops in the road one mile and a quarter south of Jarvisville near the I. C. Bennett No. 1 well (495), coming, according to the log of the latter, 300 feet above the Pittsburgh bed.

Slightly over a mile southeast of Big Isaac on the head of Stutler fork the coal has been opened near the Frank C. Curry No. 1 well (518) at an elevation of 1095' A. T. aneroid. The thickness was not ascertained here, since the mine had fallen shut.

The foregoing data on this bed in Harrison county, exhibit a much poorer development of the Uniontown, at least in crop exposures, than in Doddridge.

The Uniontown Limestone.

The **Great Limestone** of the First Geological Survey of Pennsylvania has been divided by J. J. Stevenson into two divisions; the **Upper,** 6 to 18 feet thick, coming immediately under the Uniontown coal, was designated the **Uniontown limestone** from its relation to the coal bed. In the Doddridge-Harrison area, its thickness, character and relative position in the rock column are exhibited in a fair way by the sections for Sedalia and Brown, pages 70, and 90, respectively.

Doddridge County.—In Doddridge this limestone crops over almost the same area as that outlined above for the Uniontown coal, and ranges from 10 to 15 feet thick. About 2 miles north 70°-80° west of New Milton, a sample was collected for analysis and the following section measured at an exposure of this ledge on the west bank of Lick run:

	Feet.	Inches.
1. Sandstone, Uniontown..................		
2. Shale and concealed....................	10	0
3. Limestone, bluish gray and hard........	8	0

The analysis of No. 3 is reported by Prof Hite as follows:

	Per cent.
Silica ($Si\ 0_2$)...................................	3.63
Ferric Iron (Fe_20_3)..............................	1.71
Alumina (Al_20_3)..................................	0.25
Calcium Carbonate ($CaC\ 0_3$).......................	92.26
Magnesium Carbonate ($Mg\ C\ 0_3$)...................	2.18
Phosphoric Acid (P_20_5)...........................	0.29
Total..	100.32

The above results reveal a fair quality of limestone both for agricultural purposes and road material. It adds greatly to the fertility of the soil wherever it crops in either county.

D. B. Reger measured the following section at the crop of this limestone on Jockeycamp run, three-fourths mile north of Smithton:

	Feet.
Sandstone, brown, coarse, massive, Uniontown........	30
Coal, Uniontown, and concealed.......................	25
Limestone, Uniontown, good...........................	5

(Elevation of limestone, 845′ A. T., aneroid).

It is quite probable that the upper portion of the ledge was concealed here, since the top generally comes 10 to 15 feet below the Uniontown coal and the latter bed does not exceed 4 feet in Doddridge.

This limestone crops along Big run, 2 miles northwest of Kelly P. O., at an elevation of 950′ to 960′ A. T., aneroid. On the north side of the road, nearly opposite the W. B. Maxwell No. 4 well (222), Mr. Reger measured the following section at an exposure of the stratum:

	Feet.
Sandstone, visible..................................	5
Concealed and shale.................................	5
Limestone, good, Uniontown.........................	5
Shale, red, to well (222)...........................	20

(Elevation of limestone, 960′ A. T., aneroid).

Harrison County.—In Harrison the Uniontown limestone crops over almost the same area as that outlined for the Uniontown coal. The log of the I. L. Marsh No. 1 well (373), used in connection with the Brown section, page 90, gives 30 feet of hard limestone at this horizon, immediately under the Uniontown coal. No such thickness of this stratum was observed at crop in the county. In fact, here, the Uniontown appears to be overshadowed by other cropping Monongahela limestones below it.

The Arnoldsburg Sandstone.

At 40 to 50 feet below the Uniontown sandstone in the vicinity of Arnoldsburg, Calhoun county, there occurs a great, coarse, gray, massive, pebbly and arenaceous stratum that has been designated by the writer[4] the **Arnoldsburg sandstone.**

---

[4] Wirt-Roane-Calhoun Rept., pp. 202-204, W. Va. Geol. Survey; 1911.

In the Doddridge-Harrison area, the sections given on preceding pages for Greenwood, Kelly, Katys Lick and Byron, exhibit the thickness, character and relative position of this formation in the rock column.

In **Doddridge** its crop is confined close to the crest of the Arches fork anticline, near the points where the axis of the fold intersects Buckeye creek, and Meathouse fork of Middle Island, and South and Middle forks of Hughes river. No quarries were observed on this stratum in the county.

In **Harrison** its crop is confined largely to the area east of the 800-foot contour of the Pittsburgh coal on the western slope of the Wolf Summit anticline. It passes into the air over the crest of the latter fold south from Little Tenmile creek, but comes back into the hills again in the Shinnston structural basin, to again pass into the air over the crest of the Chestnut Ridge arch and again return into the summits of the highest hills in the Grassland syncline.

In the vicinity of Clarksburg it makes steep slopes and bluffs 230 to 240 feet above the Pittsburg coal bed. According to Mr. Reger, a brown, fine grained and massive sandstone, 25 feet thick and 235 feet above the Pittsburgh coal, has been quarried for railroad ballast near the summits of the hills, one-third mile south of the city limits of Clarksburg. This quarry rock should correlate with the Arnoldsburg and not the Uniontown as generally supposed, since the latter formation belongs 300 to 310 feet above the Pittsburgh coal in this county. Likewise the T. M. Jackson quarry at the north edge of Clarksburg is on the Arnoldsburg ledge as will appear under the discussion of the Uniontown sandstone, page .... Its character, chemical composition and microscopic structure at this place, will be discussed in a subsequent chapter of this report.

The Lower Uniontown Coal.

At 90 to 100 feet below the Uniontown coal and 200 to 210 feet above the Pittsburgh bed in the Fairmont region of Marion county, there occurs a coal, 12 to 18 inches thick, that has been designated the **Lower Uniontown**[5] from its relation to the overlying seam.

In **Doddridge** the horizon of this coal crops only near the points where the axis of the Arches Fork anticline intersects Buckeye creek and Meathouse fork of Middle Island, and the South and Middle forks of Hughes river. In all other portions of the county it lies below drainage. It appears to be this coal that was once opened near the mouth of Lower run, one-half mile northeast from Summers P. O., at an elevation of 850′ A. T., aneroid, 270 to 280 feet under the Washington bed. The digging had fallen shut so that it was impossible to ascertain its thickness and character.

Three and one-half miles due northward the following section was measured at an exposure of its horizon, one-eighth mile southeast from the mouth of Sheep run:

		Feet.	Inches.
1.	Coal, Uniontown, reported (890 B-A. T.)..	1	6
2.	Concealed	35	0
3.	Sandstone, massive, Arnoldsburg........	15	0
4.	Shale, sandy...........................	2	0
5.	**Shale, black (Lower Uniontown coal horizon)**	0	2
6.	Fire clay shale.........................	3	0
7.	Concealed to river.....................	6	0

The interval, 50 feet, seems a little short between the two coals as compared to the Fairmont region, but this may be due in a measure to the westward thinning of the Monongahela series.

In **Harrison** this coal crops over practically the same area as that outlined above for the Arnoldsburg sandstone. Actual coal at this horizon was observed at only one point in the county. This was along the hill road on the head of Browns run, three-fourths mile northwest of Shinnston. There the Lower Uniontown is 6 inches thick, 200 to 210 feet above the Pittsburgh bed.

The coal does not attain minable thickness at any point in either county; hence, it is only of scientific interest.

---

[5] Vol. II(A), p. 680, W. Va. Geol. Survey; 1908.

The Fulton Green Shale.

At 80 to 90 feet above the Sewickley coal and directly over the Benwood limestone in Ohio county, W. Va., there occurs a bright green and finely laminated shale, 2½ to 5 feet thick, that has been designated by G. P. Grimsley[5a] the **Fulton Green Shale** from a town of that name just north of Wheeling where it is finely exposed.

In the Doddridge-Harrison area it crops over practically the same area as outlined above for the Uniontown limestone. It was only observed at crop, however, at one locality. This was in a railroad cut, one-fifth mile southeast from Lynch where Mr. Reger measured the following section:

	Feet.
Shales, pale green, Fulton	12
Limestone, hard, silicious, Benwood	4
Shales, limy to railroad grade	8

Here the shales have a tidal elevation of 1035′ A. T., aneroid. They do not have any special economic value, but are of scientific interest in that their coloring matter is quite persistent.

The Benwood Limestone.

The lower division of the Great Limestone of Rogers has been designated by I. C. White the **Benwood** from a town of that name in Marshall county, near which it crops in prominent cliffs. In the Doddridge-Harrison area, the thickness, character and relative position of this stratum in the rock column are given in the sections on preceding pages for Sedalia, Brown, Salem, Wolf Summit, Two Miles North of Clarksburg and Johnstown.

In **Doddridge** this limestone barely gets above drainage where the axis of the Arches Fork anticline intersects Buckeye creek and Meathouse fork of the Middle Island, and South and Middle forks of Hughes river. Here its horizon appears to be occupied mostly by dark red shales with limestone nuggets scattered throughout, especially along the two latter streams.

[5a] Ohio-Brooke-Hancock Report, page 92, W. Va. Geol. Survey; 1906.

In **Harrison** this stratum attains a fair development, and crops in the north central and eastern portions of the county. D. B. Reger collected samples for analysis and measured the following section at an exposure of the Benwood limestone on the north bank of Tenmile creek, one-half mile northeast of Marshville:

	Thickness. Feet.	Total. Feet.
Sandstone, shaly	5	5
Shale, brown	5	10
Limestone, Benwood:		
Limestone, good	4	14
Shale, gray	3	17
Sandstone, limy	2	19
Shale, gray, with limestone boulders	15	34
Limestone, silicious	3	37
Shale, variable	10	47
Limestone, shaly	10	57
Limestone, good, visible	3	60
Concealed	4	64
Limestone, good	3	67
Concealed to Tenmile creek	5	72

The two samples were collected from the ledges 10′ and 57′ from the top of the section, the composition of which is reported as follows by Prof. Hite:

	Upper Ledge. Per cent.	Lower Ledge. Per cent.
Silica (SiO_2)	8.12	7.32
Ferric Iron (Fe_2O_3)	1.13	1.18
Alumina (Al_2O_3)	2.17	0.81
Calcium Carbonate ($CaCO_3$)	83.16	88.12
Magnesium Carbonate ($MgCO_3$)	4.91	2.08
Phosphoric Acid (P_2O_5)	0.11	0.15
Totals	99.60	99.66

The results reveal a limestone much similar in composition to the same stratum on Scotts run, Monongalia county, as shown by the analysis published on page 94 of the Ohio-Brooke-Hancock report of the State Survey, and disclose a bed adapted for both road material and agricultural purposes.

Passing up Tenmile creek to the vicinity of Jarvisville, we find this ledge cropping in the road, three-fourths mile due west of the town at an elevation of 1070′ A. T. aneroid. Here it occurs in hard, yellowish gray layers, the whole having a thickness of 25 feet.

In the extreme southeastern part of the county, it crops in the hill road, 2 miles due east from Johnstown, at an elevation of 1485′ A. T. aneroid. Here it is gray, hard and slightly silicious. The Johnstown section, page 128, exhibits its position with reference to the Redstone coal, mined near the crop of the limestone.

The Upper Sewickley Sandstone.

Along the Monongahela river in Marion and Monongalia counties there occurs a massive, arenaceous stratum, 40 to 60 feet thick, immediately over the Sewickley coal, that has been designated from the latter bed the **Sewickley sandstone** by I. C. White. In this report the writer re-names it the **Upper Sewickley sandstone** in contradistinction to the Lower Sewickley ledge belonging immediately under the Sewickley coal. In the Doddridge-Harrison area, the sections given on preceding pages for Canton, Long Run, Salem, Wolf Summit, Goodhope, Clarksburg, Byron, Johnstown and Gore disclose its thickness and character.

In **Doddridge** its crop is confined to the immediate vicinity of the intersections of the axis of the Arches Fork anticline with Meathouse fork and Bluestone creek. It is this sandstone that has been quarried on the former stream near Blandville to furnish piers for the new public highway bridge over Meathouse fork at the mouth of Lick run. Here it is hard, greenish gray, micaceous and pebbly, and its top has an elevation of 820′ A. T., aneroid. According to Mr. Reger, the same ledge is quarried a short distance northeast near the mouth of Eibscamp run.

Passing southwestward along the axis of the Arches Fork anticline to Bluestone creek, we again find it elevated above drainage. Here, Mr. Reger reports it coarse and gray with large quartz pebbles, the ledge having a thickness of 30 to 40 feet.

In **Harrison** the crop of this stratum is confined mostly to that portion of the county east of the 850-foot Pittsburgh coal structure contour on the western slope of the Wolf Summit anticline. No quarries were observed on this ledge in the latter county, although it frequently attains workable thickness, hardness and purity.

The Sewickley Coal.

At 70 to 120 feet above the base of the Monongahela series in southwestern Pennsylvania and northern West Virginia there occurs quite a persistent coal bed that has been designated by the First Geological Survey ot Pennsylvania the **Sewickley coal.** The same bed has been mined to some extent near Mapletown, Greene county, Penna., and for that reason it is frequently referred to by farmers and well drillers as the **Mapletown** bed.

In the Doddridge-Harrison area, its thickness, character and relative position in the rock column are exhibited in the sections given on preceding pages for Sedalia, Centerpoint, Brown, Salem, Wolf Summit, Adamsville and Two Miles North of Clarksburg.

In **Doddridge** the crop of its horizon is confined to the immediate vicinity of the intersections of the axis of the Arches Fork anticline with Meathouse fork and Bluestone creek. No coal was observed, however, at either place. In fact, this bed appears to be absent almost entirely from the measures in this county as revealed by the logs of numerous oil and gas wells. The log of the J. Hudson diamond drill boring (21) used in connection with the Sedalia section, page 70, reports the coal only 6 inches thick.

In **Harrison** the Sewickley coal is elevated above drainage a short distance east from Brown and Marshville and crops over the larger portion of the county east of these towns. As in Doddridge, it does not appear to attain sufficient regularity and thickness to be considered an economic asset. The logs of numerous wells bored for oil and gas in almost every portion of the county fail to report this coal.

Where it crops in the road, one-third mile west of Jarvisville, it is represented by only a few inches of slaty coal, at an elevation of 1055′ A. T., aneroid. The same is true where its crop is exposed one-half mile southwest of the town.

Passing southward 4 or 5 miles to Two Lick creek, we find this bed cropping in the public highway at an elevation of 1085′ A. T., aneroid. Here it is only 12 inches thick and very slaty.

Mr. Reger reports the blossom of this coal at an elevation of 1215′ A. T., aneroid, where it crops in the public highway two miles south of Wolf Summit.

Passing to the northeastern portion of the county, we find this bed cropping in the road near the head of Mudlick run at an elevation of 1210′ A. T., aneroid. Here it is only 2 inches thick. A short distance southeast, however, on the head of Sugarcamp run, it has thickened up to 6 inches, at an elevation of 1285′ A. T., aneroid.

Passing southwest 2.5 miles to the hill road leading from Simpson creek over onto Jack run, we find this coal cropping at an elevation of 1170′ A. T., aneroid. Here, according to Mr. Reger, it is 3 feet thick, the greatest observed at crop in the area under discussion.

Four miles northward, near the east edge of Gypsy, Mr. Reger reports only a thin streak of coal at the horizon of this bed at an elevation of 1015′ A. T., aneroid.

Where it crops out in the road on Browns run, three-fourths mile northwest from Shinnston, the coal is only 6 inches thick, at an elevation of 1020′ A. T., aneroid.

Although its horizon crops over a large portion of southern and southeastern Harrison, no coal was observed at numerous exposures of the same.

The Lower Sewickley Sandstone.

At 5 to 10 feet under the Sewickley coal near Gore station, Harrison county, there occurs a buff, fine grained, micaceous, massive and arenaceous stratum, 25 to 30 feet thick, that has been named by the writer the **Lower Sewickley sandstone** in contradistinction to the Upper Sewickley above. There it has been quarried for building purposes by

F. Flowers. Its position here in the rock column is well exhibited in the Gore section, page 181. It is also noted in the section for Byron and Johnstown, pages 122 and 128, having a thickness of 20 and 30 feet, respectively. In this county it crops over practically the same area as that outlined above for the Sewickley coal.

In **Doddridge** this stratum does not get above drainage at any point in the county. Its nearest approach to cropping is near the intersections of the axis of the Arches fork anticline with Meathouse fork and Bluestone creek, where the top portion of the ledge may possibly get above stream level.

The Sewickley Limestone.

At a few feet below the Sewickley coal there occurs a calcareous stratum that has been designated by J. J. Stevenson the **Sewickley limestone** from its association with the coal of that name. Its relative position in the rock column in the Doddridge-Harrison area is exhibited in the sections for Centerpoint and Brown, pages 72 and 90, respectively, The ledge does not get above drainage in **Doddridge** county.

In **Harrison** the horizon of this limestone crops in the hills along or near the crest of the Wolf Summit anticline from Bingamon creek southward to Kincheloe creek, and eastward from this fold in the rocks across the Shinnston Basin to near the crest of the Chestnut ridge anticline where it passes into the air to return again into the hills in the Grassland Basin. In the middle and southern portions of the county it appears to have been replaced almost entirely by brown and sandy shales and sandstones, as no limestone was observed at this horizon in that region. Northward, however, at the Marion county line, it appears in good development on and near the mouth of Bingamon creek, according to D. B. Reger, who also reports it only one foot thick near the common corner to Harrison, Taylor, and Barbour counties.

At the north edge of Clarksburg, John L. Johnston, in his Pinnickinnick Hill section, page 182, reports nine feet of this limestone, immediately under the Sewickley coal. In the section for Two Miles North of Clarksburg, page 112, Mr. Reger reports the same horizon as occupied by sandy shale and limestone; hence, its distribution is quite irregular over the greater portion of the county.

The Redstone Coal.

At 50 to 70 feet below the Sewickley coal and 20 to 40 feet over the Pittsburgh seam there occurs a coal bed that has been designated the **Redstone coal** by H. D. Rogers from its outcrop along Redstone creek, Fayette, county, Penna.

Next to the Pittsburgh vein it is the most important deposit of fuel in the Doddridge-Harrison area. Its thickness, character and relative position in the rock column are exhibited in the sections given on preceding pages for Canton, Salem, Wolf Summit S., Goodhope, Grassland, Byron, Romines Mills and Johnstown.

Doddridge County.—The Redstone does not crop at any point in this county, being entirely below drainage, but in the northern portion, in the region of Centerpoint and Eagle Mills, the coal is reported in the logs of several wells drilled for oil and gas. The following table, which explains itself, is a list of the wells in which it was recorded:

List of Doddridge County Wells Recording Redstone Coal.

Map No.	Name of Well	Location	Elevation of Well Mouth A. T.	Redstone Coal	
				Depth Feet	Thickness Feet
56	Emaline Snodgrass No. 1	Centerpoint, 3½ mi. N.	980B	770	..
58	Sydney Joseph No. 1	Centerpoint, 2½ mi. N.	905B	566	..
71	Sullivan Heirs No. 1	Centerpoint, ¾ mi. N. W.	775B	419	6
79	I. J. Allen No. 1	Eagle Mills, 1.2 mi. E.	748L	500	..
80	Silas Langfitt No. 4	Eagle Mills, 0.1 mi. S. W.	743L	444	..
81	Silas Langfitt No. 7	Eagle Mills, 0.2 mi. N. W.	748B	470	..
83	O. W. O. Hardman No. 25	Eagle Mills, 1.5 mi. N.	855B?	740	..
87	W. B. Allen No. 7	Eagle Mills, 1.0 mi. N. E.	825B	500	..
88	Chas. Stewart No. 7	Eagle Mills, 0.9 mi. S. W.	748L	333	..
89	J. D. McReynolds No. 1	Eagle Mills, 1.3 mi. S.	750B	330	4
99	Wm. Sandy No. 2	Eagle Mills, 3.0 mi. S. W.	920B	550	..
100	Wm. Sandy No. 1	Eagle Mills, 3.0 mi. S. W.	1160B	798	..

The thickness was recorded in only Nos. 71 and 89. According to well drillers in this region, they were able to note only a thin streak of coal at this horizon, apparently about one foot thick, and for that reason only the depth in most cases was recorded. The record of the J. Hudson diamond drill boring (21), used in connection with the section for Sedalia, page 70, reveals its entire absence from the measures. The logs of a large number of other wells in northern Doddridge, as well as a large number in the central and southern portions of the county, fail to record the bed; hence, it is not likely that the coal attains minable thickness and regularity.

Harrison County.—Since the Redstone coal occurs only 20 to 40 feet above the Pittsburgh seam, the crop of the horizon of the former in Harrison follows closely the same area as that outlined for the latter bed. Where the coal apparently attains minable thickness and regularity in the southern and southeastern portion of the county, the crop is designated by an appropriate symbol on this map. In other portions of the area it is omitted.

In Sardis, Ten Mile, Eagle, Clay, Coal and Clark districts the coal is thin, irregular and unimportant. D. B. Reger measured the following section at an exposure of the Redstone at the point where the Pittsburgh bed passes under Little Tenmile creek, three-fourths mile northwest of Dola:

Dola Section.

			Thickness. Feet.	Total. Feet.	
Sandstone, shaly			5	5	
Slate, gray			8	13	
Sandstone, limy			3	16	
Slate, gray			3	19	
Coal, good	2' 0"	Redstone coal..	3.5	22.5	22.5'
Slate, gray	1 4				
Coal	0 2				
Slate, gray			1	23.5	
Limestone, good, to R. R. grade	5'	Redstone Limestone ..	20	43.5	
Concealed	5				
Limestone, good	10				
Concealed			7	50.5	28'
Coal, Pittsburgh.					

The section reveals the thickest coal observed at this horizon in the above mentioned districts. It evidently represents a local thickening of the bed, as another section, measured only 1.2 miles northeast of Dola on Peters run revealed but 6 inches of coal.

Passing northeastward to Jones creek, the following section was measured at its crop along the public road, one-half mile northwest of Jimtown:

	Feet.	Inches.
Shale	..	..
Coal, Redstone	0	10
Fire clay	2	0
Limestone, Redstone	3	0
Concealed	..	..

(Elevation of coal, 1040' A. T., aneroid).

Passing northeast four miles to Bingamon creek, the Redstone coal is found cropping in the north edge of Wyatt at an elevation of 990′ A. T., aneroid. Here it is only 12 inches thick, immediately over 8 feet of limestone.

Near the mouth of Cunningham run at Peora, Mr. Reger reports this bed 12 inches thick and slaty. Here it comes immediately over the Redstone limestone and 16 feet above the Pittsburgh coal. Its elevation is 965′ A. T., aneroid.

The following section was measured at the crop of the coal one mile and a half southwest of Shinnston at the mouth of Robinson run:

		Feet.	Inches.
Shale		..	..
Coal	1′ 0″		
Black slate with coal streaks	2 6 —	3	6
Fire clay shale		0	6
Limestone, Redstone		12	0

Where the bed crops in the public highway at the M. E. Denham No. 1 well (585), one mile northwest of Lumberport, it is only 4 inches thick, coming 25 feet over the Pittsburgh seam, and at an elevation of 1135′ A. T., aneroid.

Five miles southeastward and one-half mile due south of Saltwell, the coal crops in the hill road at an elevation of 1090′ A. T., aneroid. Here it is 20 inches thick and 30 feet above the Pittsburgh bed.

In the extreme southern point of Simpson district; in the southeastern portion of Elk; in the southern part of Grant; and in the southeastern portion of Union, entirely different conditions prevail with this coal. There it has frequently thickened up to seven feet, excelling both in quality and thickness in several instances the Pittsburgh bed below; the latter in this region being 2 to 3 feet thinner than in other portions of the county where it attains its best development.

Two and one-half miles southwest from Grassland, the following section was measured at the S. R. Bartlett mine in this coal on the south side of Stout run:

				Feet.	Inches.
1. Sandstone, flaggy, brown and gray, with fossil plants				10	0
2. Coal	1′	10 ″	Redstone?...	5	4¼
3. Slate, black	0	0⅛			
4. Coal	0	6			
5. Slate, black	0	0⅛			
6. Coal	3	0			
7. Concealed by water.					

(Elevation, 1220′ A. T., aneroid).

The section resembles somewhat the Pittsburgh bed, but its interval, 170 feet, above the Little Clarksburg coal, appears too great for it to represent that seam. The partings, Nos. 3 and 5 of section, may be only local or weathered conditions, as water prevented the measurement of a section inside the mine.

Three fourths mile northeastward and on the same side of Stout run, the following section was measured where both beds were opened in the same hill, one almost directly over the other. Both mines had fallen shut:

	Feet.	Inches.
Coal, Redstone, reported 6′ to	7	0
Concealed	18	0
Coal, Pittsburgh	5	0

One-fourth mile northward and two miles south of Grassland samples for analysis were collected and the following section was measured at the L. P. Loudin mine in the Redstone coal.

L. P. Loudin Mine, No. 6 on Map.

		Feet.	Inches.
1.	Sandy slate	..	..
2.	Coal	4	2
3.	Coal, cannel	0	5
4.	Fire clay.		

The samples were collected from Nos. 2 and 3 of section, the composition and calorific value of which are reported by Prof. Hite as follows:

Proximate.

	No. 2. Per cent.	No. 3. Per cent.
Moisture	0.91	0.88
Volatile Matter	35.24	32.32
Fixed Carbon	59.02	44.30
Ash	4.83	22.50
Totals	100.00	100.00
Sulphur	1.61	2.78
Phosphorus	0.004	0.039

Ultimate.

	No. 2. Per cent.	No. 3. Per cent.
Carbon	79.96	64.50
Hydrogen	5.27	3.69
Oxygen	7.35	5.31
Nitrogen	0.98	1.22
Sulphur	1.61	2.78
Ash	4.83	22.50
Totals	100.00	100.00

	No. 2.	No. 3.
Calorimeter B. T. U.	14,088	11,396
Calculated B. T. U.	14,392	11,373
Fuel ratio $= \frac{\text{Carbon.}}{\text{Oxygen} + \text{Ash}} =$	6.56	2.32

The results obtained for No. 2 show this bed to be a high grade coal. The fuel ratio (6.56) is slightly higher than that obtained for the Pittsburgh vein in Harrison county.

The following detailed hand-level section was measured along the hill road leading southwest from Brushy fork, in the extreme southern point of Simpson district:

Brushy Fork Section.

		Feet.	Inches.
Concealed			
Coal, Redstone, visible		4	0
Fire clay shale and concealed		6	0
Limestone, gray and hard, weathered yellowish	Redstone Limestone	2	0
Concealed with limestone		5	0
Shale, buff, limy		6	0
Coal 2' 5"	Pittsburgh coal. (Elevation, 1260' B-A. T.)	6	6⅛
Slate, black 0 0⅛			
Coal 0 6			
Bone 0 1			
Coal 3 6			
Concealed, aneroid measurement		140	0
Coal, Little Clarksburg		1	0
Fire clay shale		5	0
Limestone, gray and hard, Clarksburg		4	0

The section is interesting in that the detailed formations, separating the Redstone and Pittsburgh coals in this region are given. The undoubted Redstone limestone is noted, and the latter coal has its type structure of the northern end of the State. The interval between the Pittsburg and Little Clarksburg coals is shown to be only 140 feet; hence, the identification of the coal at the S. R. Bartlett mine as the Redstone, page 206, is apparently correct.

Passing 5 to 6 miles southwestward to the low gap, one-half mile east of Johnstown, we find the following section exposed at the Samuel Lewis mine on the south side of the public road:

	Feet.	Inches.
Concealed, steep bluff		
Shales, sandy	10	0
Coal, good, Redstone	5	10
Fire clay		

(Elevation of coal, 1305' A. T., aneroid).

The coal does not seem to carry any partings whatever. Like other mines in this region, the coal is used for local domestic fuel only.

The Redstone coal has been opened by John Lewis, one mile north 70 to 80 degrees west from Johnstown, at an elevation of 1405′ A. T., aneroid. Here the bed carries 5′ 10″ to 6′ 0″ of clean coal.

Three-fourths mile southeast from Johnstown, a sample for analysis was collected and the following section measured at the Gary Harris mine on the northeast side of the hill road:

Gary Harris Mine, No. 7 on Map.

		Feet.	Inches.
1.	Concealed		
2.	Coal, Redstone	7	1
3.	Concealed	30	0
4.	Coals, Pittsburgh, reported by John Harris	3	0

The sample was collected from No. 2 of section, the composition and calorific value of which is reported by Prof. Hite as follows:

Proximate Analysis.

	Per cent.
Moisture	0.76
Volatile Matter	39.03
Fixed Carbon	55.34
Ash	4.87
Total	100.00
Sulphur	2.82
Phosphorus	0.020

Ultimate Analysis.

	Per cent.
Carbon	77.27
Hydrogen	5.20
Oxygen	8.77
Nitrogen	1.07
Sulphur	2.82
Ash	4.87
Total	100.00

Calorimeter B. T. U. 13,991
Calculated B. T. U. 13,901

$$\text{Fuel ratio} = \frac{\text{Carbon}}{\text{Oxygen} + \text{Ash}} = \frac{77.27}{8.77 + 4.87} = 5.66$$

The lower fuel ratio than that given for the Loudin sample, page 207, may be attributed to the slightly higher oxygen content caused by more or less weathered conditions of coal at country banks.

The section shows a greater thickness of Redstone coal observed at crop than at any other place in the county. It also exhibits a pronounced thinning of the Pittsburgh bed.

One mile and a half southwest from Johnstown, the following section is exposed at the J. P. Queen mine in the Redstone coal, within 300 to 400 feet of the common corner to Harrison, Upshur, and Lewis counties:

	Feet.	Inches.
Sandstone, massive, forms bluff, Lower Sewickley	60	0
Slate, gray, 5′ to	10	0
Coal, clean, good Redstone	6	0
Fire clay and concealed	30	0
Coal, Pittsburgh, (thickness concealed)		
(Elevation of Redstone coal, 1363′ A. T., spirit level).		

The Redstone coal has been opened in several places by farmers on south up Rooting creek in Upshur county and across the divide on Hackers creek. There it ranges from 4 to 7 feet thick, and maintains its high reputation as a domestic fuel.

Along the southern border of Grant district, 1.5 miles due south of Rockford, the Redstone coal has been opened near the summit of the hills at an elevation of 1500′ A. T., aneroid. There its thickness is concealed, but the bed comes 10 feet below 40 feet of grayish brown, medium grained, and flaggy sandstone (Lower Sewickley).

Passing northwestward 1.5 miles to the low gap 1.4 miles southwest of Rockford, we find an old abandoned mine in this bed, 25 feet above the crop of the Pittsburgh vein at an elevation of 1430′ A. T., aneroid. Here the opening had fallen shut, but the coal was reported 6 feet thick.

In the vicinity of McWhorter station along the extreme southern border of the county, the Redstone coal has been mined on a commercial scale by three different coal companies as shown by mines Nos. 9, 10 and 11 on the General and Economic Geology map accompanying this report. Its thickness, character and composition at these mines will be discussed in a subsequent chapter.

One mile due north of McWhorter on the extreme head of Duck creek, D. B. Reger collected a sample for analysis and measured the following section at the James McIntyre mine:

James McIntyre Mine, No. 8 on Map.

	Feet.	Inches.
1. Slate, black		
2. Coal, good, no partings, Redstone	5	8
3. Shale, gray and concealed	20	0
4. Coal blossom, Pittsburgh		

(Elevation of Redstone coal, 1359′ A. T., spirit level).

The sample was collected from No. 2 of section, the composition and calorific value of which is reported by Prof. Hite as follows:

Proximate Analysis.

	Per cent.
Moisture	1.40
Volatile Matter	35.57
Fixed Carbon	58.72
Ash	4.31
Total	100.00
Sulphur	1.01
Phosphorus	0.018

Ultimate Analysis.

	Per cent.
Carbon	79.15
Hydrogen	4.96
Oxygen	9.43
Nitrogen	1.14
Sulphur	1.01
Ash	4.31
Total	100.00

Calorimeter B. T. U. 14,199
Calculated B. T. U. 13,897

$$\text{Fuel ratio} = \frac{\text{Carbon}}{\text{Oxygen} + \text{Ash}} = \frac{79.15}{9.43 + 4.31} = 5.76$$

Northward on Lost creek, northwest from Lost Creek station, the coal has been opened by farmers along both sides of the latter stream. One mile northwest from the town and on the north side of the creek, D. B. Reger measured the following section:

Section One Mile N. W. of Lost Creek.

			Feet.	Inches.
Sandstone			10	0
Coal, Redstone (thickness concealed) about.			5	0
Concealed			10	0
Limestone	1′			
Shale	5	Redstone...	8	0
Limestone	2			
Slate			3	0
Coal, Pittsburgh, about			5	0

(Elevation of Redstone coal, 1270′ A. T., aneroid).

One mile and a half northeast of Lost Creek station, the Redstone has thinned down to one foot, and about the same thickness occurs near Byron.

Passing on down Lost creek to a point one mile southeast from West Milford, we find an opening in the Redstone directly over another opening in the Pittsburgh bed, according to Mr. Reger. The Redstone coal was reported 7 feet thick by a farmer.

Crossing West Fork river into Union district, we find an old opening in the Redstone çoal on the D. M. Cole land on Two Lick creek, 1.6 miles south 20° west from Tichenal P. O., at an elevation of 1035′ A. T., aneroid. Here the mine had fallen shut, but it was reported 7 feet thick.

Southwestward on the waters of Kincheloe creek, the coal has been opened by Clark Gaston, 100 yards north of Mineral P. O. Here the following section was measured:

	Feet.	Inches
Sandstone, massive	..	..
Shale, dark	8	0
Coal, Redstone	6	0
Concealed	19	0
Limestone, Redstone	8	0
Concealed	4	0
Coal, Pittsburgh		

(Elevation of Redstone coal, 1025′ A. T., aneroid).

The coal has been opened three-fourths mile east of Mineral, opposite the mouth of Turkey run. Here the mine had partly fallen shut, but the length of the mine props used gives the bed a thickness of 4 to 5 feet.

Additional details as to the thickness, character, heat value, and probable available area of this coal will be given in a subsequent chapter of this report.

The Redstone Limestone.

Frequently most of the interval between the Redstone and Pittsburgh coals is occupied by a calcareous stratum that has been named the **Redstone limestone** by J. J. Stevenson from its association with the overlying coal.

It lies entirely below drainage in Doddridge. In Harrison this stratum crops over practically the same area as that outlined for the Pittsburgh coal bed, as it overlies the latter only one to ten feet. The sections for Grassland, Dola, Brushy Fork, and One Mile Northwest of Lost Creek, exhibit its thickness, character, and relative position in the rock column in the area under discussion.

In the extreme northern portion of Harrison, this limestone crops at an elevation of 890′ A. T., aneroid, at the north edge of Wyatt. Here it is yellowish gray, hard, and 8 feet thick, coming directly under 1 foot of Redstone coal.

Passing southeastward 1.3 miles to Peora, we find the following section exposed on the south side of Bingamon creek, according to Mr. Reger:

Peora Section.

	Feet.
Sandstone	10
Concealed	15
Coal, slaty, Redstone	1
Limestone, good, Redstone	8
Shale, gray	8
Coal, Pittsburgh	7
Concealed to creek	6

Passing southeastward from Peora 2.5 miles to the mouth of Pigeon run, we find this limestone cropping in a railroad cut. Here the following section was measured:

				Feet.	Inches.
1.	Coal	1′ 0″	Redstone	3	6
2.	Black slate with coal streaks	2 6			
3.	Fire clay shale			0	6
4.	Limestone, gray and hard, Redstone			12	0
5.	Shale, dark gray and limy			8	0
6.	Coal, Pittsburgh, visible			7	0

A sample for analysis was collected from the limestone (No. 4 of section), the composition of which is reported by Prof. Hite as follows:

	Per cent.
Silica ($Si O_2$)	10.23
Ferric Iron ($Fe_2 O_3$)	4.84
Alumina (Al_2O_3)	9.66
Calcium Carbonate ($Ca C O_3$)	54.98
Magnesium Carbonate ($Mg C O_3$)	11.86
Phosphoric Acid (P_2O_5)	0.09
Loss on ignition	9.07
Total	100.73

The result classes this ledge as a magnesian limestone, as it contains more than 10 per cent magnesium carbonate ($Mg. CO_3$). It is too high in the latter to manufacture Portland cement, but would burn into a fair quality of agricultural lime. In fact, this limestone adds greatly to the fertility of the soil wherever it crops in Harrison county.

Passing westward 4.5 miles to Jones creek, we find it cropping along the road, one-half mile northwest from Jimtown, at an elevation of 1035′ A. T., aneroid. Here, only 3 feet of the ledge is visible, 2 feet below 10 inches of Redstone coal.

Passing 2.4 miles southwestward, we find it cropping 0.7 mile northwest of Dola. Its thickness there is given in the section for Dola, page 205

It is this stratum that crops in the road, one mile northwest of Lumberport, at the M. E. Denham No. 1 well (585) at an elevation of 1130′ A. T., aneroid. Here it is 15 feet thick, directly under 4 inches of Redstone coal.

D. B. Reger collected a sample of the Redstone limestone for analysis and measured the following section on the east bank of West Fork river, 0.4 mile north of Gypsy:

Gypsy Section.

				Feet.
1.	Shales			5
2.	Sandstone, limy			1
3.	Shales, brown and concealed			10
4.	Coal, slaty, Redstone			1
5.	Limestone, silicious	7′	Redstone Limestone	12
6.	Shale, gray, limy	4		
7.	Limestone	1		
8.	Shale, limy and red			5
9.	Coal, Pittsburgh, to B. & O. R. R. grade			5

The sample for analysis was collected from No. 5 of section only, the composition of which is reported by Prof. Hite as follows:

	Per cent.
Silica ($Si\ O_2$)	16.81
Ferric Iron (Fe_2O_3)	2.65
Alumina (Al_2O_3)	3.87
Calcium Carbonate ($Ca\ CO_3$)	61.30
Magnesium Carbonate ($Mg\ CO_3$)	14.64
Phosphoric Acid P_2O_5)	0.16
Total	99.43

The analysis reveals a magnesian limestone like the sample from the mouth of Pigeon run, page 213, although it does not give a sufficient amount of the magnesium carbonate ($Mg\ CO_3$) to classify the ledge with dolomite.

At Clarksburg this limestone is reported in the Pinnickinnick Hill section, page 182, coming 5 feet under the Redstone coal and having a thickness of 6 feet.

Passing southeastward to the southern point of Simpson district, we find it cropping along the hill road leading southwest from Brushy fork, at an elevation of 1270′ A. T., aneroid. Here it is gray on fresh fracture, weathering yellowish and comes 6 feet under the Redstone coal, as will appear in the Brushy Fork section, page 208.

Passing southwest from Grassland 8 miles to the southern border of Harrison, we find this limestone cropping at the J. T. Freeman No. 1 well (723) between an opening in the Redstone coal and another in the Pittsburgh bed. Here it occupies a large portion of the interval—29 feet—separating the two coals.

Northward on Lost creek this stratum is divided into two distinct ledges by 5 feet of shale, according to Mr. Reger, as exhibited by the section for One Mile N. W. of Lost Creek, page 211.

Crossing the West Fork river to the waters of Isaac creek, one-half mile northwest of Tichenal P. O., this limestone is found 8 feet thick and quite prominent along the run near the W. B. Brown No. 1 well (496). Here, according to Mr. Reger, it was once burned for agricultural lime by Asa Burnside for Leeman Maxwell.

One mile and a half due south of Tichenal, it crops along the road. There it is yellowish and hard, 6 to 8 feet thick, 11 feet over the Pittsburg coal.

Passing southwestward 2 miles to Mineral P. O., we find the Redstone limestone cropping close to creek level at an elevation of 1000′ A. T., hand level. Here it is 6 to 8 feet thick.

Sufficient data have been given to show that the Redstone limestone ranges from 5 to 15 feet thick at nearly all portions of the county where its crop is exposed, and for that reason should furnish a very large supply of road material, as well as lime for agriculaural purposes.

The Upper Pittsburgh Sandstone.

From 1 to 20 feet over the Pittsburgh coal there often occurs a massive arenaceous stratum that has been designated the **Pittsburgh sandstone** by H. D. Rogers from its association with the coal below. Later it has been named the Upper Pittsburgh in contradistinction to the Lower Pittsburgh sandstone a short distance under the same coal.

In the Doddridge-Harrison area, the thickness, character and relative position of this formation in the rock column, are given in the sections for Sedalia and Long Run, pages 70 and 77, respectively.

It is entirely below drainage in **Doddridge**, but in **Harrison** it should crop over practically the same area as outlined for the Pittsburgh coal. In the northern portion of the latter county, it is frequently quite massive. One mile and a half southeast of Dola, it is 20 feet thick, directly over the Pittsburgh coal, according the Mr. Reger. No quarries were observed on this ledge in the county.

The Pittsburgh Coal.

The Pittsburgh coal bed is the basal formation of the Monongahela series, and it was named by J. P. Lesley in 1856 from the city of Pittsburgh, Penna., where it crops high up in the river hills. On page 164 of Vol. II of the State

Survey reports, I. C. White gives a very interesting account of this great coal seam and its influence on the industrial growth of that city and northern West Virginia.

In the area under discussion the Pittsburgh coal lies entirely below drainage in Doddridge county, but in Harrison it crops over a great portion of its area, as outlined in detail on the General and Economic Geology map accompanying this report. Thereon it will be noted that the great Wolf Summit and Chestnut Ridge anticline are responsible for its elevation above drainage. In fact, along the crests of each arch in several places it passes into the air over the summits of the highest hills.

As mentioned on preceding pages of this report, this stratum is largely used as a key rock by oil and gas well drillers to determine the position of the oil and gas bearing sands. The map referred to above also exhibits by means of contour lines, printed in green, the elevation above mean tide of the top of this coal in every portion of the two counties. It also shows the accurate location of the oil and gas wells, dry holes, and diamond drill borings, a large number of which have been given the same serial number for reference purposes, both on the map and in this report. These numbered wells have been listed in two tables, one for each county, on subsequent pages. A large number of the wells therein record not only the depth to the Pittsburgh coal, but in many instances the thickness as well. The reader is referred to these tables of wells for a large fund of information as to this bed.

In every portion of **Harrison** county, wherever not removed by erosion, the coal appears to attain minable thickness and regularity, as revealed by the logs of a large number of oil and gas wells and exposures at crop.

In **Doddridge** an entirely different condition is found to prevail The eastern one-third of its area is underlaid with Pittsburgh coal, ranging from 5 to 10 feet thick, according to well records, but the western part of the county appears to be barren of commercial coal at this horizon, although the latter is deeply buried below drainage at every point. The approximate western boundary line where the Pittsburgh

coal bed of commercial thickness and purity disappears is outlined in detail on the Economic Geology map accompanying this report.

J. J. Stevenson was the first geologist to make a detailed study of the structure of this coal. In Report K of the Second Geol. Survey of Penna., he shows that a series of thin parting clays and slates subdivide the vein into several distinct beds as follows:

1. Roof coals.
2. Over clay.
3. Breast coal.
4. Parting.
5. Bearing-in coal.
6. Parting.
7. Brick coal.
8. Parting.
9. Bottom coal.

A full description of the character and thickness of these separate beds is given by I. C. White on pages 166-172 of Vol. II, W. Va. Geol. Survey reports.

At this time there are 60 to 70 commercial mines in the Pittsburgh coal in Harrison, and none in Doddrigde. All are driven in directly on the crop of the bed or by slope. The following is a general type section of the seam as exhibited in these mines:

	Feet.	Inches.
1. Draw slate	..	..
2. Roof coal	1	0
3. Coal	1	2
4. Bone	0	1
5. Coal	0	4
6. Bone	0	0¼
7. Coal	0	3
8. Bone	0	1
9. Coal	4	9
Total	7	8¼

Nos. 2 and 3 of the section correspond to the "breast coal" of Stevenson; Nos. 5-7 to the "bearing-in coal"; and No. 9 to the "brick" and "bottom" coals. It will be noted that the "bearing-in coal" carries a thin parting (No. 6) in this region.

The thickness, character, composition, and calorific value of the coal at the several commercial mines, as well as local country banks, will be discussed in detail in a subsequent chapter on the coal resources of the two counties. Likewise, an estimate will be given on the probable available area of the bed by magisterial districts.

CHAPTER VII.

THE CONEMAUGH SERIES.

The Conemaugh series is that division of the rock column that begins at base with the top of the Upper Freeport coal and extends up to the base of the Pittsburgh coal bed. This group of rocks was formerly known as the Lower Barren Measures, and later as the Elk River series. The name **Conemaugh** was the earliest applied to the series by Franklin Platt in 1875, from the outcrop along Conemaugh river in Cambria county, Penna. In Vol. II, pp. 225-226 of the State Survey reports, I. C. White gives an interesting account of this series in West Virginia.

This group of rocks lies entirely below drainage in Doddridge, but in Harrison, the Wolf Summit and Chestnut Ridge anticlines elevate the series into the hills and valleys. The Conemaugh crop in this county is outlined in detail on the General and Economic Geology map accompanying this report, and its thickness ranges from 525 feet in northwestern Doddridge to almost 600 feet in southeastern Harrison.

The writer has compiled the following general section of the Conemaugh series in West Virginia from a large number of detailed sections of these measures as published in the State Survey reports. As these rocks were first studied and described in Pennsylvania, a large percentage of the names are taken from places in that State. Several have been added later, however, from Ohio and West Virginia:

General Section of Conemaugh Series in West Virginia.

	Thickness. Feet.	Depth. Feet.
Fire clay and shale	5	5
Sandstone, massive, Lower Pittsburgh	35	40
Shale, gray	3	43
Upper Pittsburgh Limestone	4	47

	Thickness. Feet.	Total. Feet.	
Coal, Little Pittsburgh	1	48	48′
Fire clay and gray shale	7	55	
Lower Pittsburgh Limestone	10	65	
Shale, sandy and red	58	123	
Sandstone, massive, pebbly, Connellsville	25	148	
Coal, Little Clarksburg	2	150	102′
Shale, dark	5	155	
Limestone, gray and hard, Clarksburg	10	165	
Shale, sandy and red	48	213	
Sandstone, massive, Morgantown	40	253	
Coal, Elk Lick	2	255	105′
Fire clay and shale	10	265	
Limestone, gray, Elk Lick	5	270	
Shale, sandy and red, Birmingham	10	280	
Sandstone, massive, pebbly, Grafton	20	300	
Limestone, fossiliferous, Upper Ames	4	304	
Shale, fossiliferous, dark green	15	319	
Limestone, fossiliferous, Lower Ames	3	322	
Shale, dark	6	328	
Coal, Harlem	2	330	75′
Fire clay and shale, red	10	340	
Limestone, gray, Ewing	5	345	
Red shale, "Pittsburgh Reds"	40	385	
Sandstone, massive, Saltsburg	40	425	
Coal, Bakerstown	1	426	96′
Fire clay	3	429	
Limestone, Pine Creek	1	430	
Shale	15	445	
Sandstone, massive, pebbly, Buffalo	50	495	69′
Brush Creek limestone... 5′ Shale, black.............10 Coal, Brush Creek........ . Sandstone, Mahoning to base of Series.......80 Don't outcrop in Doddridge-Harrison area.	95	590	95′

SECTIONS.

In Chapter IV a number of sections of the Conemaugh series in both counties are published. In addition, several scattered sections of these measures as exposed at crop in Harrison will now be given.

The following section was measured with aneroid from the summit of a high knob on the head of Ann run in the northeast corner of Simpson district, northeastward along the hill road to Corbin branch of Booths creek. Additional formations were added from exposures along the road leading southwest down Ann run:

Section on Head of Ann Run, Simpson District.

	Thickness. Feet.	Total. Feet.	
Monongahela Series (10')			
Sandstone, massive, capping knob, Upper Pittsburgh	10	10	10'
Conemaugh Series.			
Concealed	35	45	
Coal blossom, trace, Little Pittsburgh	0	45	
Concealed and fire clay	29	74	
Limestone, gray and brecciated	1	75	
Sandstone, massive, coarse, Connellsville	20	95	
Concealed	39.5	134.5	
Black slate, Little Clarksburg coal horizon	0.5	135	125'
Limestone, gray and hard..1' Limestone, yellowish.......4 } Clarksburg	5	140	
Concealed, massive sandstone and concealed	29.5	169.5	
Limestone, gray and hard (6")	0.5	170	
Concealed and shale	5	175	
Fire clay shale	5	180	
Shale, red	5	185	
Shale, red, concealed and sandstone	32	217	
Concealed	3	220	
Coal blossom, Elk Lick	0	220	85'
Fire clay shale	15	235	
Concealed	5	240	
Shale, red	10	250	
Sandstone, Grafton	40	290	
Shale, red and brown	15	305	
Concealed and shale	4	309	
Coal, Harlem, 8" to	1	310	90'
Shale, reddish brown, Pittsburgh	39.5	349.5	
Limestone, nodular, buff	0.5	350	
Concealed	30	380	
Coal ....0' 11 " Slate, gray...0 0½" Coal ....0 6 } Bakerstown coal	1.46	381.46	71.46'
Fire clay and concealed to Corbin branch level due east of northeast corner Simpson district	5	386.46	5'

The section was measured almost along the strike of the strata and for that reason the intervals and totals are approximately correct.

The following section of the Conemaugh series was measured with aneroid by D. B. Reger from an opening in the Pittsburgh coal near the low gap southwest of Tyconnell Mines, Taylor county, southwestward along the hill road leading down to Beards run:

Beards Run Section, Simpson District.

	Thickness. Feet.	Total Feet.	
Concealed	20	20	
Sandstone, flaggy, Lower Pittsburgh	30	50	
Concealed	40	90	
Sandstone, shaly	10	100	
Concealed	10	110	
Shale, brown	10	120	
Concealed	24.5	144.5	
Coal (6"), Little Clarksburg	0.5	145	145'
Concealed	25	170	
Shale, red	10	180	
Sandstone, flaggy	10	190	
Shale, variegated	20	210	
Sandstone, flaggy, Morgantown, to foot of hill road	25	235	
Concealed	74	309	
Coal, Harlem	1	310	165'

The following section of the top portion of the Conemaugh series was measured from an opening in the Pittsburgh coal northeastward along the hill road leading down to Lost creek, two miles west of the town of that name:

Section Two Miles West of Lost Creek, Grant District.

	Thickness. Feet.	Total. Feet.
Concealed	29	29
Fire clay, Little Pittsburg coal horizon	1	30
Concealed	30	60
Shale, red	20	80
Concealed, mostly sandstone	35	115
Sandstone, shaly, Connellsville	10	125
Shale and concealed	4	129
Coal, Little Clarksburg	1	130

The following section of the upper portion of the Conemaugh series was measured with aneroid from an opening in the Pittsburgh coal located in the low gap, two miles southwest of Goodhope, northward along the hill road to Two Lick creek:

Section Two Miles Southwest of Goodhope, Union District.

	Thickness. Feet.	Total. Feet.
Concealed	10	10
Shale	5	15

	Thickness. Feet.	Total. Feet.	
Sandstone, Lower Pittsburgh	10	25	
Concealed	25	50	50′
Fire clay	0	50	
Shale, red and buff	15	65	
Concealed	15	80	
Sandstone, flaggy	15	95	
Concealed	10	105	
Shale, dark red, limy	5	110	
Concealed	20	130	
Shale, red	9	139	
Limestone, gray and hard, Clarksburg	1	140	90′
Shale, red	10	150	
Shale, sandy, buff	5	155	
Concealed	18	173	
Limestone, shaly, gray, nodular	2	175	
Concealed to Two Lick Creek	70	245	105′

The Little Pittsburgh coal probably belongs in the 25 feet of concealed interval immediately over the fire clay at 50 feet from the top of the section.

DESCRIPTION OF THE CONEMAUGH FORMATIONS

The Lower Pittsburgh Sandstone.

At 5 to 10 feet under the Pittsburgh coal there often occurs a massive, arenaceous stratum, 10 to 40 feet thick, that has been designated the **Lower Pittsburgh sandstone.** It is the highest formation yet described and named in the Conemaugh series.

In the Doddridge-Harrison area, its thickness, character, and relative position in the rock column are exhibited in the sections given on preceding pages for Centerpoint, Long Run, Wolf Summit, and Byron. It does not get above drainage in **Doddridge**, but in **Harrison** its horizon crops to the surface either in whole or in part over practically the same portion of the county as that outlined for the Pittsburgh coal.

According to D. B. Reger, this stratum crops just above water level along Bingamon creek, one-half mile below Peora. Here it is 20 feet thick, and its base has an elevation of 955′ A. T., aneroid.

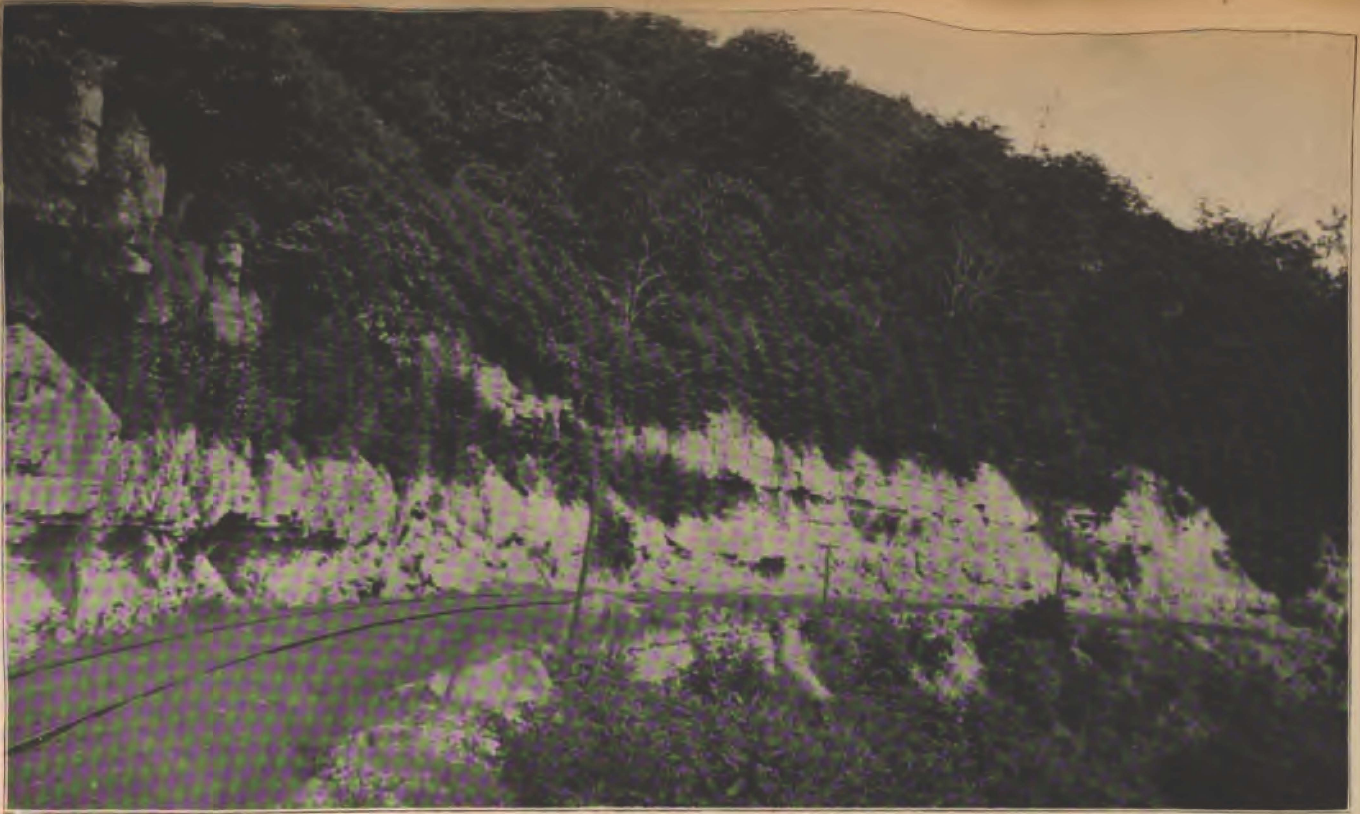


PLATE VI.—Lower Pittsburgh Sandstone and Pittsburgh Limestones cropping along the W. Va. Short Line R. R. grade, two miles north of Clarksburg.

Passing eastward to the west bank of West Fork river, we find a quarry on this ledge near the school house opposite Viropa. Here, according to Mr. Reger, it is gray, medium grained and hard, and has been quarried and crushed quite extensively to furnish ballast for the Fairmont & Clarksburg electric railroad. The ledge has a thickness of 35 feet, and its base an elevation of 915′ A. T., aneroid.

Near the school house on Flaggy run, 0.9 mile northwest of Sardis, this sandstone crops in a conspicuous bluff, its base extending to 30 feet below an opening in the Pittsburgh coal. Here the ledge is gray and coarse.

In the section given for Gore, page 181, 10 feet of the bottom portion of the ledge is recorded, 32 feet below the Pittsburg coal. Here it is massive and quite limy, forming in conjunction with the Pittsburgh limestone conspicuous bluffs eastward along the W. Va. Short Line Branch of the B. & O. Railroad.

Passing to the eastern part of Simpson district we find it cropping along the hill road leading northeastward from Beards run, 2¼ miles southeast from Oral. Here, according to Mr. Reger, it is flaggy, 30 feet thick, and 20 feet below an opening in the Pittsburgh coal. The interval between the latter and the sandstone observed was concealed; hence, probably 10 feet of the top portion of the ledge was invisible.

The Upper Pittsburgh Limestone.

At 30 to 40 feet below the Pittsburgh coal there often occurs a calcareous stratum, 1 to 5 feet thick, that has been designated the **Upper Pittsburgh limestone** by I. C. White[1] from its association with the Pittsburgh coal and in contradistinction to the Lower Pittsburgh limestone.

It lies below drainage in **Doddridge**, but it is noted in the log of the boring used in connection with the Centerpoint section, page 72, coming there 31 feet below the Pittsburgh coal horizon and having a thickness of 6 feet.

---

[1] Vo'. II, page 245, W. Va. Geol. Survey; 1903.

In **Harrison** this limestone crops over practically the same area as that outlined above for the Lower Pittsburgh sandstone. The only points in the county that it was definitely identified was near Gore station of the Fairmont & Clarksburg electric railroad and in a railroad cut 1 mile northwest of Glen Falls. At the former place an exposure reveals it only 6 inches thick, gray and hard, coming 4 feet under the Lower Pittsburgh sandstone, directly over the horizon of the Little Pittsburgh coal, and 3.5 feet above the Lower Pittsburgh limestone. It has the same thickness at the latter place, coming directly over the Little Pittsburgh coal and 9 feet over the Lower Pittsburgh limestone.

D. B. Reger measured the following section at an exposure of a limestone at the south edge of Clarksburg, that appears to represent the Upper Pittsburgh ledge:

					Feet.	Inches.
1.	Coal	1'	0"	Pittsburgh	8	1
2.	Concealed	4	0			
3.	Coal	3	0			
4.	Limestone, gray and hard				4	0
5.	Concealed				123	0
6.	Sandstone, Connellsville				30	0
7.	Concealed to Elk Creek				30	0

Its close proximity with the Pittsburgh coal makes it appear rather doubtful whether or not it correlates with the Upper Pittsburgh limestone, and if so, the Lower Pittsburgh sandstone has been cut away entirely. Otherwise, it is merely a local deposit, as no limestone was observed so close under the Pittsburgh coal in any other portion of the county.

Mr. Reger collected a sample of the limestone (No. 4 of section) for analysis, the composition of which is reported by Prof. Hite as follows:

	Per cent.
Silica ($Si\ O_2$)	6.51
Ferric Iron (Fe_2O_3)	1.95
Alumina (Al_2O_3)	1.93
Calcium Carbonate ($Ca\ CO_3$)	85.88
Magnesium Carbonate ($Mg\ CO_3$)	2.13
Phosphoric Acid (P_2O_5)	0.33
Loss on ignition	0.39
Total	99.12

The results reveal a bed adapted for road material and for the manufacture of agricultural lime. The phosphoric acid content is higher than that found in the results on preceding pages for the Uniontown, Benwood, and Redstone limestones.

The Little Pittsburgh Coal.

At 40 to 50 feet under the Pittsburgh coal there frequently occurs a thin coal that has been designated the **Little Pittsburgh** by I. C. White[2] from its association with the overlying bed.

In **Doddridge** this coal lies below drainage, but in **Harrison** it crops to the surface over almost the same area as outlined for the Pittsburgh bed. The sections given on preceding pages for Wolf Summit S., Wilsonburg S., Gore, and Byron exhibit its thickness, character and relative position in the rock column. It does not attain merchantable thickness and regularity at any point in either county.

The following section was measured at an exposure of this bed in a railroad cut, one mile northwest of Glen Falls:

Glen Falls Section.

	Feet.	Inches.
Coal blossom, Pittsburgh	..	..
Concealed	4	0
Sandstone, massive, Lower Pittsburgh	15	0
Limestone, gray and hard, Upper Pittsburgh	0	6
Coaly shale and slate, Little Pittsburgh	3	0
Shale, gray, limy	6	0
Limestone, silicious, broken	4	0
Shale, red to railroad grade	3	6

The following section was measured at an exposure of this seam just north of Peora on Bingamon creek:

	Feet.	Inches.
Sandstone, massive, Lower Pittsburgh	30	0
Coal, Little Pittsburgh	0	10
Shale, gray	0	10
Limestone, dark gray, with shale layers	6	0

---

[2] Vol. II, pp. 245-246, W. Va. Geol. Survey; 1903.

Crossing West Fork river to Coon run in the northern part of Clay district, we find this coal cropping almost flush with the top of the Alice Corpening No. 1 well (612). Here it is only 6 inches thick.

Both the Gore and Glen Falls sections note its horizon, and show that the bed belongs in the interval between the Upper and Lower Pittsburgh limestones.

Passing to the southeast corner of Harrison to a point one mile northwest from Johnstown, we find this coal cropping along the hill road leading southwest to Lost creek. Here it is 12 inches thick, and has an elevation of 1370′ A. T., spirit level, coming 25 to 30 feet under the Pittsburg bed.

Just across the Harrison line in the northern edge of Upshur, an exposure of this coal is found along the road leadiing up Rooting creek, 2¾ mile due south of Johnstown. Here it is 18 inches thick and quite slaty.

The Lower Pittsburgh Limestone.

At 50 to 60 feet under the Pittsburgh coal and 1 to 5 feet under the Little Pittsburgh bed, there occurs a calcareous stratum that has been designated by I. C. White[3] the Lower Pittsburgh limestone. It lies below drainage in **Doddridge** county.

In **Harrison** this ledge attains a fair development as revealed by the sections for Gore and Glen Falls, pages 181 and 227, respectively. At the former place its thickness, including 3 feet of gray, limy shale 1′ 6″ above the bottom is 11′ 6″, coming 50 feet below the Pittsburgh coal. At the latter point it is only 4 feet thick, coming 30 to 35 feet under the same coal. The ledge appears to be very silicious at both localities and does not seem to have any economic importance, except for road material.

---

[3] Vol. II, p. 245, W. Va. Geol. Survey; 1903.

The Connellsville Sandstone.

At 75 to 100 feet under the Pittsburgh coal there occurs a coarse, brown and massive sandstone of great economic importance. The stratum rises from the bed of the Youghiogheny river at Connellsville, Penna., from which locality it was named by J. J. Stevenson. The reader is referred to pages 247-248 of Vol. II of the State Survey reports for a detailed description of this ledge in West Virginia.

In the Doddridge-Harrison area the sections given on preceding pages for Centerpoint, Salem, Goodhope, Wilsonburg S., Byron, Romines Mills, and Johnstown exhibit its thickness, character, and relative position in the rock column.

It lies entirely below drainage in **Doddridge,** but crops to the surface in **Harrison** along the crest of the Wolf Summit anticline; along West Fork river, south of Farnum; over all that portion of the county south, southeast and east of Clarksburg; and the eastern border of Clay and Simpson districts. It generally forms a steep slope around the hill sides wherever it crops.

According to D. B. Reger it is this stratum that forms the rapids in West Fork river at Meadowbrook station on the Fairmont & Clarksburg electric railroad. One mile due westward, its crop is exposed on Lambert run. There it is quite massive and 30 feet thick.

This sandstone crops along the hill road, three-fourths mile southwest of Wilsonburg at an elevation of 1090' A. T., aneroid. Here it is coarse and brown at bottom, green and medium grained at top, and 35 feet thick.

Passing southeastward 3.5 miles to the hill road leading northward from the mouth of Coburn creek, we find this ledge cropping at an elevation of 1055' A. T., aneroid. Here it is 30 feet thick, coarse, brown and pebbly, coming 65 feet under the crop of the Little Pittsburgh coal.

In the eastern portion of Simpson district, Mr. Reger reports this sandstone cropping on the head of Davisson run, 1.6 miles southwest of Oral, at an elevation of 1275' A. T., aneroid. Here it is 35 feet thick, coarse, brown and pebbly.

Passing to the extreme eastern point of the district, we find it cropping, according to Mr. Reger, along the hill road leading northeast from Pigtail run to the common corner to Harrison, Taylor and Barbour counties, at an elevation of 1160′ A. T., aneroid. Here it is 20 feet thick, massive, coarse, and very pebbly, coming directly over one foot of Little Clarksburg coal.

At the south edge of Clarksburg an exposure reveals 30 feet of this sandstone. Southward along West Fork river and Browns creek, it has been quarried quite extensively for building purposes. The first quarry occurs on the east bank of the river, one-half mile northwest of Lewis (Lynch Mines). Here, according to Mr. Reger, it makes a prominent cliff 35 feet high, at an elevation of 1020′ A. T., aneroid. Stone from this quarry was used in lining the railroad tunnel, one mile southwest of Clarksburg. A section measured with hand level by Mr. Reger at Lewis, gives the following succession:

Lewis (Lynch Mines) Section.

	Feet.
Coal, Pittsburgh	8
Concealed and brown shale	68
Sandstone, Connellsville	38
Concealed to river level	66

Passing southeastward up Browns creek to a point one-half mile northwest of Byron (Mt. Clare), we find a quarry in this ledge on the land of J. B. Smith, on the west side of the railroad. Here Mr. Reger collected a sample of the sandstone for analysis and obtained the following data:

		Feet.
1.	Sandstone, flaggy	8
2.	Sandstone, massive	15
3.	Concealed to B. & O. R. R	8

"The sandstone has bedding planes running through it at distances varying from 1 to 8 feet. Joint planes run N. 10° E. and N. 40° W. The upper part of the ledge is medium grained, steel gray, hard, and weathers to a brown color. The lower 4 feet has small quartz pebbles. Quarry is on north side of hollow and has been worked back into the hill about 100 feet, and is about 300 feet long, and quarried out farther in the middle, so that its face is semi-circular and runs about N. 15° E. Only 3 to 4 feet of soil on top of stone. The quarry is now owned or leased by the Byron Domestic Coal Co. Stone from here was used in the construction of the Short Line R. R. bridges at Clarksburg, and of the Federal building at the latter place."

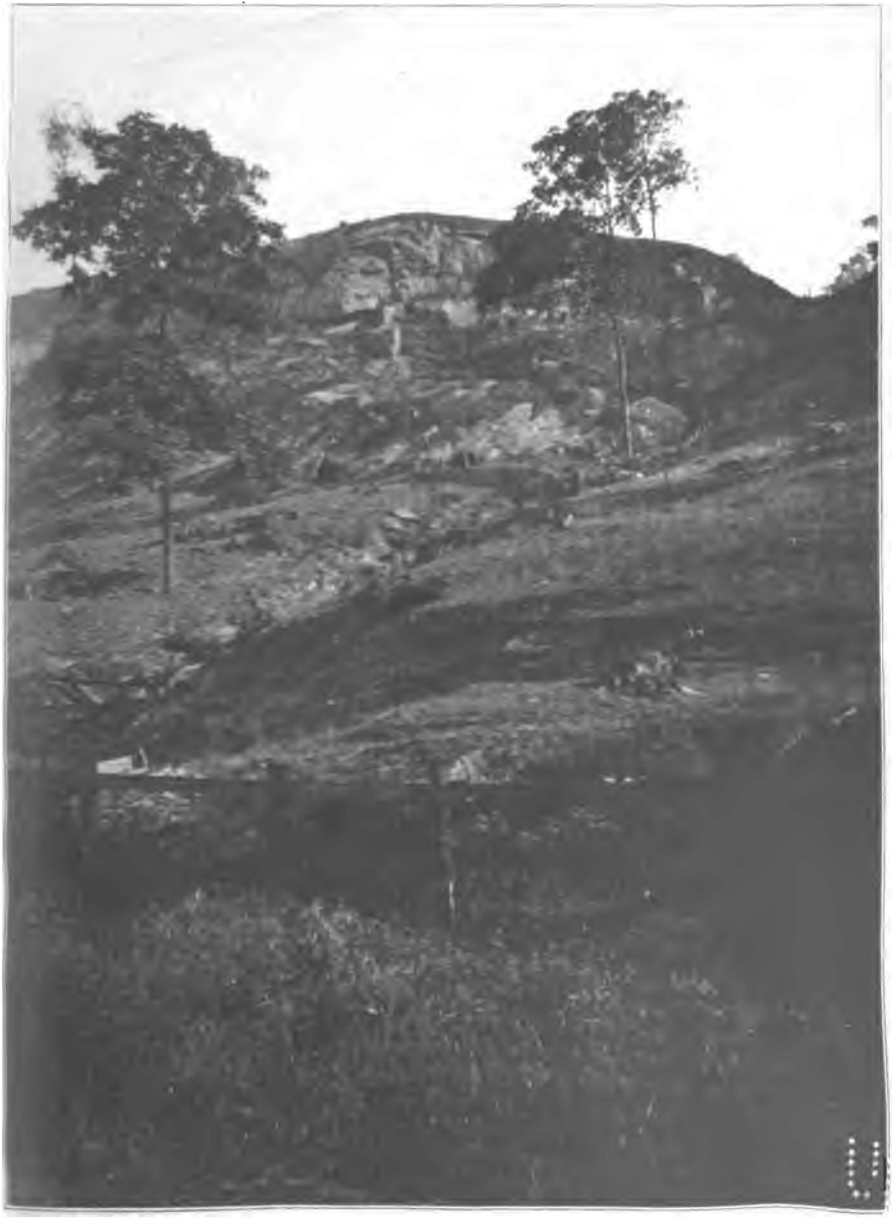


PLATE VII.—Quarry near the summit of hill at Byron, Harrison county, in Connellsville sandstone.

Mr. Reger collected the sample for analysis from No. 2 only of section, the composition of which is reported by Prof. Hite as follows:

	Per cent.
Silica ($Si\ 0_2$)	85.32
Ferric Iron (Fe_20_3)	6.30
Alumina (Al_20_3)	2.46
Lime ($Ca\ 0$)	1.06
Magnesia ($Mg\ 0$)	0.70
Sodium (Na_20)	1.09
Potassium (K_20)	0.71
Titanium ($Ti\ 0_2$)	0.20
Phosphoric Acid (P_20_5)	0.44
Loss on ignition	2.27
Total	100.55

The results reveal the cause of the durability of this rock when used for building purposes, as it contains no calcium carbonate ($CaCO_3$) whatever, and has for its cementing principle a fairly large per cent of the oxide of iron (Fe_20_3).

Another quarry on the same stratum is opened a short distance to the southeast on the land of John Wagner. A water well drilled near these two quarries showed the ledge slightly over 40 feet thick.

Crossing West Fork river at a point 2 miles due west from West Milford, we find this stratum cropping along a private road on the land of Smith Bros., according to Mr. Reger, who reports it 20 feet thick, and shaly, coming 10 feet over the Little Clarksburg coal.

The Little Clarksburg Coal.

◆

From 110 to 130 feet under the Pittsburgh coal, and 1 to 10 feet under the Connellsville sandstone there occurs a very persistent coal bed in northern West Virginia that has been named the **Little Clarksburg coal** by I. C. White who gives the following interesting account of this bed at its type locality in Harrison county on pages 248-249 of Vol. II, W. Va. Geological Survey:

> "Just under the Connellsville sandstone there comes a widely persistent coal bed, which the writer named from the city of Clarksburg where it crops along the valley of Elk creek and the West Fork river.

The coal is often double, with two or three feet of slate or shale separating as many feet of impure, bony coal, so that in the Allegany and Garrett county, Maryland, area, the bed is frequently termed the "Dirty Nine-Foot" coal. This double character of the coal is exhibited along Elk creek, below Quiet Dell, in Harrison county, and also in the vicinity of Berryburg, Barbour county, as well as on Gnatty Creek and other tributaries of Elk in Harrison county. The same feature has been noted in Lewis and Upshur.

"This stratum was named the Little Clarksburg coal by the writer because in the vicinity of Clarksburg, where the bed was first studied and described, the main Pittsburgh coal, which is there extensively mined, is locally known as the 'Clarksburg' coal."

In **Doddridge** this coal does not get above drainage, but it is noted in the log of the boring used in connection with the Long Run section, page 77. It does not attain minable thickness and regularity in this county.

In **Harrison** this coal is recorded in the sections given on preceding pages for Goodhope, Wilsonburg S., Clarksburg, Bridgeport, and Grassland. In this county it crops over practically the same area as that outlined above for the Connellsville sandstone.

In the western portion of Eagle district, this coal crops along the Short Line railroad, one-fourth mile southeast from Dola, at an elevation of 963′ A. T. spirit level, where the following section was measured:

				Feet.	Inches.
Sandstone, massive, Connellsville				20	0
Shale, dark				4	0
Slate, cannelly	0′	8″	Little Clarksburg	7	4
Limestone, silicious	0	6			
Shale, with limestone	5	0			
Coal	1	2			
Fire clay				0	6
Limestone, yellow and hard, Clarksburg				2	0
Concealed					

The section illustrates the double-bedded character of the coal, and the presence of a thin limestone between the upper and lower benches.

Passing eastward to the road fork, 0.6 mile northeast from the mouth of Little Tenmile creek, in the same district, we find this coal cropping at an elevation of 1040′ A. T. aneroid. Here the following section was measured:

			Feet.	Inches.
Shale, dark			2	0
Coal	0′ 6″	Little Clarksburg	10	4
Shale	9 0			
Coal	0 10			
Shale			4	0
Limestone, yellow and hard, Clarksburg			1	0

Another section of this coal in Eagle district, measured in the northeast edge of Lumberport, is as follows:

			Feet.	Inches.
Sandstone, Connellsville				
Shale, sandy and dark			6	0
Coal	0′ 10″	Little Clarksburg	6	0
Limestone, silicious, 3″ to	0 6			
Shale, gray	4 0			
Coal	0 8			
Fire clay shale			1	0

(Elevation of coal, 960′ A. T., aneroid).

Passing to the northeastern portion of the county in Clay district we find this coal cropping at the road fork, one-half mile west of McAlpin P. O., at an elevation of 1130′ A. T., aneroid where the following section was measured:

	Feet.	Inches.
Coal, slaty	2	0
Slate, gray	0	1
Coal, better	0	8½
Total	2	9½

In Coal district, the writer collected a sample of the coal for analysis and measured the following section at the crop of this bed along the Fairmont & Clarksburg electric railroad, at the mouth of Crooked run:

Section at Coal Opening, No. 85 on Map.

		Feet.	Inches.
1.	Sandstone, visible	4	0
2.	Shale, sandy	10	0
3.	Shale, dark gray	5	0

4.	Coal, slaty	0′	1″	Little Clarksburg	6	4½
5.	Limestone, gray and hard	0	6			
6.	Shale, gray	0	3			
7.	Coal, slaty	0	2			
8.	Shale, dark, with limestone concretions	4	0			
9.	Coal	0	4			
10.	Slate, gray	0	0½			
11.	Coal, good	1	0			
12.	Slate, black, fossiliferous				0	1
13.	Limestone, gray, and hard	2′	6″	Clarksburg	7	6
14.	Concealed	3	0			
15.	Limestone, gray and hard	2	0			
16.	Concealed					

Sample from No. 11 of section only, the composition of which is reported by Prof. Hite as follows:

Proximate Analysis.

	Per cent.
Moisture	1.25
Volatile Matter	30.96
Fixed Carbon	43.33
Ash	24.46
Total	100.00
Sulphur	8.22
Phosphorus	0.043

Ultimate Analysis.

	Per cent.
Carbon	56.38
Hydrogen	4.03
Oxygen	5.91
Nitrogen	1.00
Sulphur	8.22
Ash	24.46
Total	100.00

Calorimeter B. T. U. 10,572
Calculated B. T. U. 10,573

$$\text{Fuel ratio} = \frac{\text{Carbon}}{\text{Oxygen} + \text{Ash}} = \frac{56.38}{5.91 + 24.46} = 1.86$$

Although the sample was collected from the best portion of the bed, yet the results reveal a very low grade of fuel. The high percentage of sulphur and ash make it very unsatisfactory for any purpose even in farming regions where other coal might not be available.

In Clark district, this coal crops at an elevation of 980′ A. T., aneroid, in a railroad cut, one-fifth mile southeast from West Clarksburg station. Here it is 12 inches thick, coming 3 feet over 23 feet of Clarksburg limestone, according to D. B. Reger.

In the northern portion of Simpson district, the coal crops along the hill road on the head of Ann run, at an elevation of 1270′ A. T., aneroid. Here it is represented by 6 inches of black slate immediately over 5 feet of Clarksburg limestone.

Passing southwest in Simpson to the old clay digging on the ridge one mile due north of Bridgeport, we find 2 feet of slaty coal cropping at this horizon, at an elevation of 1195′ A. T., aneroid.

Southward in the same district we find the coal cropping along the road near the head of Coplin run, 1.8 miles due north of Grassland P. O. Here Mr. Reger measured the following section:

			Feet.	Inches.
Coal, good	1′ 6″	Little Clarksburg	6	0
Slate	3 0			
Coal, good	1 6			
Slate			4	0
Concealed			3	0
Limestone, good, Clarksburg			3	0

(Elevation of coal, 1135′ A. T., aneroid).

The section reveals more good coal in this bed than observed at any other exposure in the county. The thick parting slate between the two benches, however, would make it very expensive to recover the coal.

In the extreme southern point of Simpson district, the coal crops along the road leading southwest from Brushy fork, 1¼ miles south of Grassland, P. O., at an elevation of 1070′ A. T., aneroid, coming 135 feet under the Pittsburgh bed. The following section was measured at this point:

			Feet.	Inches.
Coal	0′ 8″	Little Clarksburg	6	8
Fire clay shale	5 6			
Coal, slaty	1 0			
Black slate, fossil fish teeth, etc			8	0
Limestone, gray and hard, Clarksburg			5	0

Both benches have thinned considerably from that reported in the preceding section.

The coal crops around the hill sides over most of the area of Elk district. Where it is exposed along the hill road, one mile northeast from Craigmoor P. O., the bed is only 6 inches thick, at an elevation of 1175′ A. T., aneroid.

Passing southeastward in the same district to near the school house on Stout run, we find 10 inches of this coal visible at an elevation of 1050′ A. T., aneroid, coming 170 feet under an opening in what appears to be the Redstone coal on the S. R. Bartlett farm.

Farther southeastward in Elk district, the coal crops along the hill road leading north from Raccoon run. At this place the bed is slaty, 16 inches thick, coming at an elevation of 1075′ A. T., aneroid.

Its crop was observed at several places in Union district and the bed has practically the same development as in other portions of the county. A section measured on the Smith Bros. land 2 miles due west of West Milford, exhibited 12 inches of this coal, directly over 8 feet of Clarksburg limestone. Another along the hill road leading north from the mouth of Coburn creek, revealed only 4 inches of coal, at an elevation of 1055′ A. T., aneroid.

The Clarksburg Fire Clay Shale.

In eastern Harrison county there occurs a fairly pure fire clay shale immediately below the Little Clarksburg coal and above the Clarksburg limestone. For that reason the writer has named it the **Clarksburg fire clay shale.** It was once quarried for pottery purposes on the ridge, one mile and a half due north of Bridgeport. There the writer collected a sample of the clay for analysis and measured the following section at the old abandoned clay pit:

	Feet.	Inches.
1. Shale, buff	5	0
2. Coal, slaty, Little Clarksburg	2	0
3. Fire clay shale, medium hard; buff, Clarksburg	5	0

Sample from No. 3 of section, the composition of which is reported as follows by Prof. Hite:

	Per cent.
Silica ($Si\ 0_2$)	55.40
Ferric Iron (Fe_20_3)	1.28
Alumina (Al_20_3)	26.18
Lime	1.04
Magnesia ($Mg\ 0$)	0.80
Soda (Na_20)	0.82
Postassa (K_20)	1.87
Titanium ($Ti\ 0_2$	0.45
Phosphoric Acid (P_20_5)	0.75
Moisture	4.98
Loss on ignition	6.86
Total	100.43

The results show this bed to have almost identically the same composition as the Washington fire clay shale of the Dunkard series, as exhibited on pags 163 of the Wirt-Roane-Calhoun report of the State Geological Survey. The clay obtained here was once mixed with alluvial clays occurring near Bridgeport, and manufactured into all kinds of stoneware, jars, jugs, crocks, etc. The pit has finally been abandoned. The composition of this shale shows it, like the Washington, adapted to the manufacture of building brick. In fact, it burns into a fine buff colored brick good for both building and paving purposes, according to Gordon B. Late, Superintendent of the W. Va. Pottery company, at Bridgeport. Its crop is confined practically to the same area as that outlined for the Little Clarksburg coal. It appears to be very irregular, however, and often thins away entirely.

The Clarksburg Limestone.

Immediately under the Clarksburg coal in the vicinity of Clarksburg, Harrison county, there occurs a calcareous stratum that has been designated the **Clarksburg limestone** by I. C. White, who gives the following interesting account of the formation at its type locality on pages 249-250 of Vol. II of the State Geol. Survey reports:

"Directly below the last described coal and its underlying fossiliferous black slate, there often occurs a limestone which is finely exposed in the vicinity of Clarksburg along Elk creek, at its junction with the West Fork river, and was named by the writer from that

> locality, the Clarksburg limestone. Its upper portion is generally rather slaty and filled with fossil ostracoids and fish remains, but the lower layers are compact and massive. The whole stratum is often twenty to thirty feet thick, and some of the layers are quite ferruginous, so much so that they were once mined as ore and used in the manufacture of iron at an old charcoal furnace on Elk, near Clarksburg. Some iron ore was also obtained for this furnace from the ferruginous shales just above the Little Clarksburg coal.
>
> ‘“The Clarksburg limestone has a wide distribution in the northern end of the State, and has frequently been quarried and burned into lime for fertilizing purposes. It also makes excellent road material and has been extensively used for that purpose on the streets and roadways in the vicinity of Clarksburg.”

This stratum does not get above drainage in **Doddridge** county, but in **Harrison** it crops over practically the same area as that outlined above for the Little Clarksburg coal. D. B. Reger measured the following detailed section of the bed from an exposure in a railroad cut, one-fifth mile southeast from West Clarksburg station:

West Clarksburg Section.

			Feet.
Coal, Little Clarksburg			1
Slate, black			1
Sandstone, limy			2
Limestone	1'	Clarksburg Limestone	23
Shale, dark	3		
Limestone, good	6		
Shale, limy	4		
Limestone	1		
Shale, dark	2		
Limestone, good	6		
Shale, limy, to railroad grade			4
Concealed to level of West Fork river			20

The following section was measured at the crop of this ledge along the road on Barnett run, one mile and three-fourths northwest of Bridgeport:

	Feet.	Inches.
1. Black slate (Little Clarksburg coal	0	6
2. Fire clay shale	5	0
3. Limestone, gray and hard, weathered yellow, Clarksburg	10	0

A sample was collected from the limestone, No. 3 of section, the composition of which is reported by Prof. Hite as follows:

	Per cent.
Silica ($Si\,O_2$)	13.90
Ferric Iron (Fe_2O_3)	2.04
Alumina (Al_2O_3)	10.92
Calcium Carbonate ($Ca\,CO_3$)	60.30
Magnesium Carbonate ($Mg\,CO_3$)	3.34
Phosphoric Acid (P_2O_5)	0.25
Loss on ignition	9.19
Total	99.94

The sample is quite high in both silica and alumina and low in magnesium carbonate; hence, it is probably best adapted to the manufacture of hydrated lime for agricultural purposes. It is quite hard and for that reason should furnish an abundant and convenient supply of good road material for the eastern portion of the county.

In the northeastern corner of Simpson district, this stratum is 5 feet thick and quite hard where it crops along the road on the head of Ann run. Here its elevation is 1265′ A. T., aneroid.

In an exposure at the mouth of Crooked run, 1.5 miles northwest of Clarksburg, the limestone comes immediately below the Little Clarksburg coal, and almost flush with the grade of the Fairmont & Clarksburg electric railroad. Here 7.5 feet of the upper portion of the ledge is visible.

In the southern part of Simpson district, the crop of this ledge is exposed at the mouth of Glade run, at Grassland P. O., where the following section was measured:

			Feet.
Coal, Little Clarksburg			1
Limestone	1′	Clarksburg Limestone.	8
Shales, limy	5		
Limestone	2		

In the northern part of Elk district, the Clarksburg limestone crops a short distance above drainage on Stout run. Here it is 5 to 8 feet thick, gray and hard on fresh fracture, and weathering yellowish on exposure.

Crossing West Fork river into Union district, we find, according to D. B. Reger, the following section exposed at this horizon on the land of Smith Bros., 2 miles due west of West Milford:

			Feet.
1.	Sandstone, shaly, Connellsville		20
2.	Concealed		10
3.	Coal, Little Clarksburg		1
4.	Limestone	Clarksburg Limestone.	8
5.	Shale, dark		
6.	Limestone		

Mr. Reger collected a sample of the limestone for analysis from Nos. 4 and 6 of section, the composition of which is reported by Prof. Hite as follows:

	Per cent.
Silica ($Si O_2$)	14.86
Ferric Iron (Fe_2O_3)	2.19
Alumina (Al_2O_3)	5.02
Calcium Carbonate ($Ca CO_3$)	71.91
Magnesium Carbonate ($Mg CO_3$)	2.65
Phosphoric Acid (P_2O_5)	0.61
Loss on ignition	2.43
Total	99.67

The results reveal a limestone adapted to the manufacture of Portland cement, having the proper ratio of percentages of silica and alumina, and a comparatively low magnesium carbonate content. They also show that it is adapted to the manufacture of hydrated lime for agricultural purposes.

The Clarksburg Red Shale.

In the vicinity of Clarksburg, Harrison county, the writer has designated the 25 to 40 feet of red and variegated shales immediately below the Clarksburg limestone the **Clarksburg red shales.** D. B. Reger measured the following hand-level section at an exposure of these shales at the railroad tunnel, one mile southwest of Clarksburg:

	Thickness. Feet.	Total. Feet.
Sandstone and concealed	30	30
Coal, slaty, Little Clarksburg	1	31
Limestone, concealed and limestone, Clarksburg	25	56
Shale, red and variegated, Clarksburg	35	91
Shale, sandy, to railroad grade	8	99
Concealed to West Fork river	25	124

Mr. Reger collected a sample of these shales for analysis in the shale pit of the Monticello Brick Company, located a short distance northeastward at the mouth of Arnold run, the composition of which is reported by Prof. Hite as follows:

	Per cent.
Silica ($Si\ 0_2$)	51.20
Ferric Iron (Fe_20_3)	10.78
Alumina (Al_20_3)	12.46
Lime ($Ca\ 0$)	6.04
Magnesia ($Mg\ 0$)	1.12
Soda (Na_20)	1.63
Potassa (K_20)	4.46
Titanium ($Ti\ 0_2$)	0.22
Phosphoric Acid (P_20_5)	0.53
Loss on ignition	11.31
Total	99.75

These red shales in the upper portion of the Conemaugh series are almost as pronounced in the Doddridge-Harrison area as the Pittsburgh reds, 150 feet lower in the measures, and they generally form a bench or more gentle slope around the hill sides a few feet below the steep bluffs and slopes made by the Connellsville sandstone. Their crop in the area under discussion is confined to practically the same area as that outlined for the Clarksburg coal.

The Morgantown Sandstone.

At 50 to 60 feet below the Clarksburg limestone there occurs a massive, arenaceous stratum, ranging in thickness from 20 to 40 feet, that has been designated the **Morgantown sandstone** by J. J. Stevenson from the city of that name in Monongalia county, at which place it has been quarried extensively for building purposes. It is this sandstone that is frequently referred to by all well drillers in the northwestern portion of the State as the "Murphy sand". It lies entirely below drainage in **Doddridge** county.

In **Harrison** its thickness, character, and relative position in the rock column is given in the sections for Adamsville and Byron, pages 107 and 122, respectively. Its crop is confined in this county to the eastern portion of Clay district; the central and southern portions of Simpson; the western portion of Elk; that portion of Grant south from Byron; and the eastern margin of Union. In the two latter districts the ledge appears to attain its best development in the area under discussion.

It is this ledge that forms the cliff along the west bank of West Fork river at the mouth of Coburn creek, in the northeast corner of Union district. There D. B. Reger measured the following section:

	Feet.
Sandstone, gray and massive, Morgantown...........	40
Shales and concealed to river........................	15
(Elevation of sandstone, 957′ A. T., spirit level).	

In the southwest corner of the same district this ledge forms an escarpment around the hill sides. It is this stratum that makes the cliff on the east bank of West Fork, one-fifth mile northwest from the mouth of Hackers creek, at an elevation of 1085′ A. T., aneroid. Here it is a great massive, buff sandstone, 40 to 50 feet thick.

Passing southeastward up Hackers creek to a point one-third mile due north of the mouth of Bens run, we find this ledge making cliffs 40 to 50 feet high, at an elevation of 1110′ A. T., aneroid.

In Union district, Mr. Reger reports the Morgantown sandstone making cliffs along the west bank of the river, 0.8 mile northeast from Goodhope. Here the ledge is massive, gray, medium grained, and 20 feet thick.

No quarries were observed on this stratum in the area under discussion.

The Elk Lick Coal.

From a few inches to 10 feet under the Morgantown sandstone there occurs a fairly persistent coal bed that has been designated the **Elk Lick coal** by the First Geological Survey of Pennsylvania from a stream of that name in Somerset county, Penna., along which it crops with a thickness of 4 feet. The bed varies from 2½ to 4 feet in Monongalia county, W. Va., and contains much ash and bony material.

In **Doddridge** this coal lies entirely below drainage and it appears to be absent from the measures in this county, since the logs of numerous wells bored for oil and gas therein fail to note the bed.

In **Harrison** the thickness and relative position of the coal in the rock column is exhibited in the sections for Two Miles North of Clarksburg and West Milford, pages 112 and 100 respectively. The thickness recorded for the coal in the former sections—6 feet—is excessive, as no such thickness was observed at the many exposures at crop of this bed in the county. This is a good illustration of the unreliability of the average logs of churn drill borings for oil and gas, in recording the thickness of coal veins.

Near the northeastern corner of Clay district, this coal crops in the road in the northeast edge of Boothsville, at an elevation of 990′ A. T., aneroid. Here it is represented by 2 inches of slaty coal, coming 4 feet above the Elk Lick limestone and 11 feet above the Grafton sandstone cliff rock at this town.

Passing southwestward in the same district up Thomas fork of Booths creek, we find this coal cropping along the road above the mouth of Sugarcamp run to the Clay-Simpson district line, at elevations of 1075′ to 1090′ A. T., aneroid. Here it varies from 2 to 6 inches thick according to D. B. Reger.

Southwestward in Simpson district on Barnett run, Mr. Reger reports a coal cropping along the public road that is 6 inches thick, at an elevation ranging from 1045′ to 1065 A. T., aneroid.This coal correlates with the Elk Lick bed, coming as it does, 240 to 250 feet below the Pittsburgh coal. Eastward on the head of Ann run, the Elk Lick coal crops along the hill road, at an elevation of 1185′ A. T., aneroid. Here it is only 2 inches thick.

Passing southwestward in the same district to a point one-half mile northwest from Bridgeport, we find this coal cropping along the road at an elevation of 1048′ A. T., spirit level. Here the coal is 6 inches thick, coming at the base of a massive sandstone (Morgantown).

The horizon of this coal is exposed in a cut along the

Baltimore & Ohio railroad grade, one mile westward from Bridgeport. Here the coal has thinned away almost entirely, being represented by streaks of coal at the top of 10 feet of fire clay shale at the base of the Morgantown sandstone, immediately above 4 feet of Elk Lick limestone.

Passing southeastward in Simpson district to a point 2.3 miles northeast from Quiet Dell, we find the Elk Lick coal bed represented by 6 inches of black slate only, at an elevation of 1120' A. T., aneroid, coming 50 to 60 feet above the Harlem coal bed.

One mile and a half northwest from Grassland P. O., the Elk Lick coal crops along the second class road, leading northward from Brushy fork. Here it is only 4 inches thick and slaty, coming 60 to 70 feet below the Little Clarksburg coal.

In Grant district, the Elk Lick bed crops along the hill road leading south from the railroad, 1.5 miles northeast from the town of Lost Creek, at an elevation of 1180' A. T., aneroid. Here it is 8 inches thick and slaty. It crops along the road, 0.4 mile northwest from Lost Creek station, at an elevation of 1065' A. T., aneroid, and there it is only 6 inches thick and slaty.

Along the western border of Grant district, the horizon of this coal is exposed at the bridge across the river at West Milford. Here the coal has thinned away entirely, being represented by only 2 feet of fire clay shale at the base of the Morgantown sandstone, 4 feet above the Elk Lick limestone, and 240 feet by hand level below an opening in the Pittsburgh coal.

The crop of the horizon of the Elk Lick coal was observed at only one place in Union district. This was in the southeast corner of the latter area at a point one-fifth mile northwest from the mouth of Two Lick creek. Here the following section was measured:

	Feet.	Inches.
Sandstone, Morgantown..................		
Shale, red..............................	10	0
Shale, buff.............................	10	0
Shale, black (Elk Lick coal horizon).......	0	4
Fire clay shale..........................	1	0

	Feet.	Inches.
Shale, sandy	4	0
Shale, buff and limy	12	0
Limestone, gray and hard, with shale layer, Elk lick	6	0
(Elevation of Elk Lick Coal, 1020', A. T., aneroid, at 260' below Pittsburgh coal).		

The several sections and data given above for the Elk Lick coal show that the bed is worthless from an economic standpoint in the area under discussion; hence, it is of scientific interest only, in that it aids in the correlation of other more important formations of the Conemaugh series.

The Elk Lick Limestone.

At 10 to 20 feet below the coal last described there occurs a widely persistent calcareous stratum in southwestern Pennsylvania and northern West Virginia that has been named by Messrs. Platt[4] the **Elk Lick limestone.** It is of fresh or brackish water origin, ranging in thickness from 5 to 15 feet in several layers, separated by shales.

In **Doddridge county** this ledge lies entirely below drainage.

In **Harrison** it crops over practically the same area as that outlined for the Elk Lick coal bed. Near the northeast corner of Clay district, the crop of this limestone is exposed just across the county line in the edge of Taylor, in the southwest edge of Boothsville, at an elevation of 960' A. T., spirit level. Here the ledge is gray and hard, 5 feet thick, coming immediately over the Grafton sandstone.

Passing southwestward to Bridgeport in Simpson district, we find the following section exposed in a cut along the Baltimore & Ohio railroad, one mile west of the town:

	Feet.
Sandstone, massive, gray micaceous, limy, Morgantown	25
Fire clay shale	3
Sandstone, shale and flaggy	5
Fire clay shale, streak of coal at top, Elk Lick	10
Limestone, brecciated, Elk Lick	4
Shale, limy and red, Birmingham	4
Sandstone, shaly to railroad grade	4

---

[4] Report H H H, Second Geological Survey of Penna.

In the western portion of Grant district the writer collected a sample of this ledge for analysis and measured the following section on the east bank of West Fork river near the bridge over the latter stream at West Milford:

West Milford Section—Local.

			Feet.	Inches.
1.	Sandstone, massive..15'	Morgantown Sandstone ..	20	0
2.	Shale, sandy......... 5			
3.	Fire clay shale (Elk Lick coal horizon).		2	0
4.	Limestone, gray and hard ....2' 0"	Elk Lick Limestone .	9	3
5.	Shale, limy, with limestone 1 6			
6.	Limestone, gray and hard, conglomerate 2 6			
7.	Shale, limy and gray 2 0			
8.	Limestone, gray and hard, conglomerate 1 3			
9.	Shale, gray and limy..................		3	0
10.	Coal ....0' 2"	West Milford coal (Elevation, 960' A. T., spirit level).	1	1
11.	Slate, black..0 1			
12.	Coal 0 10			
13.	Shale, dark...........................		3	0
14.	Limestone, ferriferous, lenticular.......		0	3
15.	Shale, gray..........................		2	0
16.	Sandstone, gray, medium hard, Grafton, to river bed....................		5	0

The section is very interesting in that a new coal makes its appearance in the measure; viz., **West Milford,** coming as it does 5' 3" above the Grafton sandstone, 3 feet below the Elk Lick limestone and 256 feet by hand level below an opening in the Pittsburgh coal bed.

The limestone sample was collected from Nos. 4, 6 and 8 of section, the composition of which is reported by Prof. Hite as follows:

	Per cent.
Silica ($Si O_2$)..................................	2.40
Ferric Iron (Fe_2O_3)............................	1.77
Alumina (Al_2O_3)................................	0.48
Calcium Carbonate ($Ca CO_3$)......................	94.23
Magnesium Carbonate ($Mg CO_3$)....................	1.74

Phosphoric Acid (P_2O_5)	0.26
Total	100.88

Mr. Reger collected a sample of the same ledge 35 to 50 feet northward from the point at which the above section was measured, the composition of which is reported by Prof Hite as follows:

	Per cent.
Silica ($Si\ O_2$)	9.06
Ferric Iron (Fe_2O_3)	4.03
Alumina (Al_2O_3)	3.55
Calcium Carbonate ($Ca\ CO_3$)	79.13
Magnesium Carbonate ($Mg\ CO_3$)	2.11
Phosphoric Acid (P_2O_5)	0.76
Loss on ignition	1.45
Total	100.09

The above results reveal a limestone adapted to the manufacture of white and gray limes for masons, bricklayers and plasterers; hydrated lime for agricultural purposes; Portland cement; and for road material.

Passing eastward in the same district to near Lost Creek, we find this ledge, according to Mr. Reger, cropping in a ravine, 0.2 mile northwest from town. Here he reports the limestone 2 to 3 feet thick, gray, and very hard, with minute fresh water fossil shells.

Passing to the extreme southern border of Grant district, we find the Elk Lick limestone cropping along the east hill side of McKinney run, one-third mile northwest of McWhorter station, at an elevation of 1105′ A. T., aneroid. Here it is gray, hard, and 3 feet thick, coming 240 to 250 feet below an opening in the Pittsburgh coal bed.

In Union district the crop of this ledge is exposed 1.2 miles southwest from Goodhope, on and near the mouth of Two Lick creek, at an elevation of 1000′ A. T., aneroid. Here it is interlaminated with shale layers, the whole having a thickness of 6 feet.

Southwestward 1.6 miles to the waters of Kincheloe creek, we find this limestone cropping near the fork of a second class road at an elevation of 985′ A. T., aneroid. Here it occurs in layers separated by limy shales, the whole having a total thickness of 20 to 25 feet.

The Birmingham Shale.

Immediately under the Elk Lick limestone in southwestern Pennsylvania and northern West Virginia there occurs 25 to 50 feet of variegated and sandy shales that have been designated by J. J. Stevenson[4a] the **Birmingham shales** from a former town of that name on the south side of the Monongahela river at Pittsburgh, Pa., where they crop, with a jointed appearance, and slip badly on the almost vertical face of the hill. These shales as limited by Mr. Stevenson at their type locality, are 48 feet thick, extending from 11 feet below the Morgantown sandstone, down to a limestone, 3 feet in thickness. The latter formation most likely correlates with the Upper Ames limestone, coming as it does there 59 feet below the Morgantown sandstone and 24 feet above the Crinoidal (Lower Ames) limestone.

They lie entirely below drainage in **Doddridge** county.

In **Harrison** their crop is confined to practically the same area as that outlined for the Elk Lick coal. In the eastern portion of the county, they have been largely replaced by the great, massive Grafton sandstone.

The Grafton Sandstone.

At 1 to 15 feet below the Elk Lick limestone there often occurs a great massive, coarse and pebbly sandstone, in Taylor county ranging in thickness from 20 to 40 feet, that has been designated by I. C. White[5] the **Grafton sandstone** from its crop near the summit of the hills at a town of that name in the latter area. This stratum is lenticular in character and often replaces the Birmingham shale almost entirely.

Its thickness, character and relative position in the rock column in the Doddridge-Harrison area are exhibited in the sections given on preceding pages for Long Run, Brown, Boothsville, Quiet Dell and Byron.

[4a] Report K, pp. 79 and 309-310, Sec. Geol. Survey of Penna.

[5] Vol. II, p. 255, W. Va. Geol. Survey.

In **Doddridge** county this stratum lies entirely below drainage.

In **Harrison** this sandstone crops along the crest of the Wolf Summit anticline; along the crest of the Chestnut Ridge anticline in a belt 2 to 3 miles in width southward from the head of Ann run in the northeast corner of Simpson district; and in the southern border of Grant district.

From north to south across the county the Grafton sandstone first rises above drainage in the northeast corner of Clay district, and at the public highway bridge over Booths creek, 1.1 miles southward from Boothsville, it has an elevation of 996′ A. T., spirit level.

Southwestward from the latter point to the Clay-Simpson district line, this stratum forms the floor of Thomas fork, and in a large measure its hardness is responsible for the wide bottom lands along the latter stream.

In Simpson district this sandstone forms bluffs and steep slopes around the hill sides on Ann and Peddler runs; Simpson creek eastward from the west edge of Bridgeport; Davisson, Douglass and Beards runs; and Brushy fork. It does likewise in Elk district southeastward along Elk creek from the mouth of Brushy Fork to the mouth of Rooting creek; on Suds, Hastings, and Stevens runs; and on Rooting creek southwestward to a point 1.5 miles northward from Johnstown. In a similar manner it makes its presence known in Grant district eastward from a point one-half mile northwest of Lost Creek station. It barely gets above drainage on McKinney run near McWhorter. In the southwest corner of the district, and in the southeast corner of Union this sandstone forms bluffs and steep slopes along Bens run, Hackers creek, West Fork river south from Goodhope, Two Lick and Kincheloe creeks a short distance up to two latter streams.

No quarries were observed on this ledge in the county, although the sandstone gives excellent results where quarried for building purposes near Grafton on account of its durability.

The Ames Limestones.

At 275 to 320 feet below the top of the Conemaugh series, and 5 to 20 feet below the Grafton sandstone, there occurs a calcareous and very fossiliferous stratum in northern West Virginia that has been named by Andrews and Orten in the State Geological Reports of Ohio, the **Ames limestone.** It frequently occurs in two layers each 1 to 5 feet in thickness, separated by 10 to 20 feet of dark, fossiliferous shale, the top member being called the **Upper Ames,** and the bottom, the **Lower Ames.** The dark green fossiliferous shale separating the two ledges is designated by the writer the **Ames shale** from its association with these limestones. Both ledges nearly always contain a large number of marine fossils, and from a geological standpoint, these limestones are considered the most interesting formations in the entire Appalachian field. In Vol. II, pages 256-261 of the State Survey reports, I. C. White gives a detailed description of the distribution, character and fossil fauna of the Ames limestone in this State, to which the reader is referred.

In **Doddridge** county neither of these limestones gets above drainage.

In **Harrison** their crop is confined to practically the same area as that outlined above for the Grafton sandstone. Passing from north to south across the county these limestones first get above drainage along the extreme eastern edge of Clay district on Booths creek, 1.2 miles southward from Boothsville. Southwestward in Simpson district, the writer collected a sample of each ledge for analysis, and measured the following section on Ann run, 2 miles northeast from Bridgeport:

		Feet.	Inches.
1.	Limestone, dark gray, fossiliferous, hard Upper Ames	0	10
2.	Shale, dark green	15	0
3.	Limestone, dark gray, silicious, fossiliferous, Lower Ames	2	0
4.	Shale, bluish and dark gray, fossiliferous at top	8	0
5.	Coal, good, Harlem	1	4
6.	Shale, gray to bed of Ann run	1	0

Samples for analyses were collected from Nos. 1 and 3 of section, the composition of which is reported by Prof. Hite as follows:

	Upper Ames. Per cent.	Lower Ames. Per cent.
Silica ($Si\ 0_2$)	7.55	18.13
Ferric Iron (Fe_20_3)	3.05	2.08
Alumina (Al_20_3)	25.08	4.77
Calcium Carbonate ($Ca\ C0_3$)	40.73	48.33
Magnesium Carbonate ($Ca\ C0_3$)	15.77	21.31
Phosphoric Acid (P_20_5)	1.39	0.19
Loss on ignition	6.49	4.95
Totals	100.06	99.76

The results reveal that both ledges are impure limestones in this region. In fact, their horizons are often occupied by dark, limy shales, containing the same marine fossils. They do not appear for these reasons to have any economic importance, except for road material.

The following section was measured in a Baltimore & Ohio railroad cut, one-fifth mile west of the station at Bridgeport:

	Feet.	Inches.
Shales, sandy	10	0
Shale, red	5	0
Sandstone, shaly, Grafton	10	0
Limestone, ferriferous and fossiliferous, with shale layers, Upper Ames	4	0
Shale, reddish brown	14	0
Limestone, fossiliferous in upper portion, Lower Ames	2	6
Shale, dark	0	6
Coal, Harlem	1	10
Fire clay shale	2	0
Shale to railroad grade	3	0

A collection of the fossils from both ledges of the Ames was made at this point for study and classification, the results of which are found on subsequent pages of this report. The Lower Ames appears to be a more persistent ledge than the Upper in this county.

Passing southeastward along the railroad from Bridgeport to a cut 0.5 mile southeast from Oral station, we find the following section exposed, according to D. B. Reger:

	Feet.
Sandstone, massive, Grafton	7
Shale, gray	3
Sandstone, shaly	3
Shale, gray	4
Limestone, Lower Ames	1
Shale, gray	4
Coal, Harlem	1½
Shale, brown, limy, fossiliferous	10
Sandstone, shaly to railroad grade	20

The Upper Ames limestone has thinned away entirely at this point.

In the southwest corner of Simpson district the Ames limestone crops along the hill road, 2 miles northeastward from Quiet Dell, and northwest of the residence of Chas. J. Roy, at an elevation of 1080′ A. T., aneroid. Here the Lower Ames is 2 feet thick, 10 feet above 18 inches of Harlem coal.

The following section in the northern portion of Elk district, measured at the triangle of roads, 1.4 miles southeast of Quiet Dell, exhibits both the Upper and Lower Ames:

	Feet.	Inches.
Limestone, Upper Ames, fossiliferous	0	6
Shale, dark green, Ames	15	0
Limestone, Lower Ames, fossiliferous	5	0
Shale, dark	10	0
Coal, Harlem	1	6
Fire clay		

On the western border of the same district we find the Lower Ames cropping along the hill road on the head of Hastings run, one-half mile northwest from the Arthur Conley No. 1 gas well (736), at an elevation of 1185′ A. T., aneroid. Here the ledge is only 6 inches thick and fossiliferous, coming 5 feet above 18½ inches of Harlem coal.

In the southern portion of Elk district, Mr. Reger measured the following section along the road, 2 miles north 75° to 80° east from Rockford:

	Feet.
Shale, greenish brown	20
Limestone, fossiliferous, Lower Ames	2
Shale	5
Coal, streak, Harlem	

(Elevation of limestone, 1080′ A. T., aneroid).

In Grant district the Lower Ames crops in the road, one-fifth mile northwest from Lost Creek station, at an elevation of 1040′ A. T., spirit level. Here it is only one foot thick, 3 feet above 30 inches of Harlem coal. In the extreme western edge of the same district this limestone rises above West Fork river on the axis of the Wolf Summit anticline, 0.6 mile northeast from Goodhope, at an elevation of 965′ A. T., aneroid. Here according to Mr. Reger, 2 feet of the ledge is visible, very fossiliferous, on the east bank of the river, opposite a water pump station. It is also exposed on the east side of the river, 0.7 mile due south of Goodhope, at an elevation of 985′ A. T., aneroid. Here the ledge is quite fossiliferous with only 2 feet of the same visible.

In the southern border of Grant district the crop of the Lower Ames is exposed along the second class road, one-fifth mile eastward from the mouth of Bens run of Hackers creek, at an elevation of 1035′ A. T., aneroid. Here the following section is revealed:

	Feet.	Inches.
Shale, sandy, buff	15	0
Limestone, shaly, with fossiliferous shells, Lower Ames	3	0
Shale, buff, limy	3	0
Coal, Harlem	0	10
Fire clay and shale to road	10	0

Passing to the southwest corner of Union district, we find the Lower Ames cropping along the road, 0.4 mile northwest from the mouth of Kincheloe creek, at an elevation of 1025′ A. T., aneroid. Here it is quite shaly, very fossiliferous, and 4 feet thick.

Fossil Fauna.—The Ames is one of three rich fossil horizons of the Conemaugh series. Collections were made in the field by D. B. Reger and the writer along with Dr. J. W. Beede of the University of Indiana. The specimens were identified by Dr. Beede who has made a special study of the Carboniferous invertebrate fossils of the west. He reports some 54 species in all, some of which have not before been reported from the Appalachian region, and others not from the Ames limestone, so far as he is aware. His report is as follows:

"The fossils in the following list are from two general localities in Harrison County—Bridgeport and Lost Creek. The Bridgeport material was largely from the black shales over the Friendsville (Harlem) coal an eighth of a mile west of Bridgeport station. This horizon is designated number "1" in the list that follows. The limestone above it is given as number "2". Two or three miles northeast of Lost Creek station some pieces of Ames limestone were found in a cut in the side of the road and were brought in. This horizon and locality is given as number "3" in the table and number "4" is a cut in the side of the road one-tenth mile northwest of Lost Creek. The fossils from this place were in olive-colored shales with some calcareous material at the base.

Some worms, ostracods and minute gastropods were collected from the Elk Lick limestone above the cut at Lost creek. These are not included in the table below. The black shale fauna is considerably dwarfed.

Fossils from the horizon of the Ames Limestone of Harrison County, West Virginia.	1.	2.	3.	4.
Crinoid segments and plates		x		
Worm borings in shells		x		
Brachiopod sp.				x
Chonetes granulifer	a		a	a
Chonetes laevis				x
Chonetes variolatus	x			
Composita argentia		a		x
Derbya crassa	c	x		
Productus cora	x	x		x
Productus nebraskensis	x	x	x	
Strophalosia sp.	x	x	x	
Astartella cf. gurleyi	x			
Aviculopecten cf. rectilaterarius				x
Aviculopecten? sp.				x
Aviculopecten whitei?				x
Aviculopinna americana				x
Cardiomorpha? sp.	x			
Edmondia sp.				x
Nucula parva	a			c
Nucula sp.				x
Nucula ventricosa	x			
Nuculana bellistriata	x			x
Pelecypod sp.				x
Pinna peracuta			x	
Pleurophorus sp.				x
Prothyris elegans				x
Schizodus? sp	x			
Sedgwickia cf. topekensis				x
Aclisina stevensana	x			
Aclisina swallowana	x			
Bellerophon percarinatus	c			x?
"Bellerophon" sp.			x	
Bellerophon stevensanus	a			x
Bulimorpha chrysalis	a			
Bulimorpha sp.	x			
Bulimorpha sp.	x			
Euphemus carbonarius	a			x
Gastropod sp.	x			
Gastropod sp.				x
Gastropod sp.		x		
Loxonema scitulum	x			
Loxonema semicostatum	x			
Patellostium montfortianum	x			
Plagioglypta meekana	x			
Pleurotomaria sp.	x			
Sphaerodoma primogenia			x	
Soleniscus brevis	x			
Tainoceras occidentalis?	x			
Ostracoda, several species	x	x		x
Vertebrate remains, fragments			x	

"In the columns to the right in the above list, the "a" signifies that the specimens of the species of fossils were quite abundant; the "c", that they were common, that is present in numbers; and the "x", rare to fairly numerous."

The Harlem Coal.

From a few inches to 10 feet below the Lower Ames limestone there occurs in the northwestern portion of the State a very persistent coal. It was named the Crinoidal coal by the First Geol. Survey of Penna., and later the Friendsville coal by G. C. Martin of the Maryland Geol. Survey. According to J. J. Stevenson, the designation, **Harlem coal** by J. S. Newberry, from a town of that name in Carroll county, Ohio, where it was worked in shafts[6], has priority in geological nomenclature.

In **Doddridge** county this coal lies entirely below drainage, but it is recorded in the log of the Wm. Flanagan No. 1 well (198), used in connection with Greenwood section, page 80. This is the only place the coal was noted in the records of a large number of wells.

In **Harrison** the Harlem coal crops over practically the same area of the county as that outlined for the Ames limestones. Its relative position in the rock column is exhibited in the sections given on preceding pages for West Milford, Bridgeport, Grassland, Byron, and Romines Mills. Measurements at crop show that it ranges in thickness from 10 to 30 inches.

In the northeastern corner of Simpson district, Mr. Reger collected a sample of this coal for analysis, and measured the following section near the head of Anns run on the land of J. I. Brohard:

Opening No. 87 on Map.

	Feet.	Inches.
1. Shale, greenish	10	0
2. Limestone, silicious, fossiliferous, Lower Ames	1	0
3. Shale, dark gray	8	0
4. Coal, Harlem	1	4
5. Shale, gray, to bed of Anns run	1	0

(Elevation of coal, 1055′ A. T., aneroid).

The sample was collected from No. 4 of section, the composition of which is reported by Prof. Hite as follows:

---

[6] Bull. Geol. Soc. of America, Vol. 17, p. 156; 1906.

Proximate Analysis.	Per cent.
Moisture	0.70
Volatile Matter	36.50
Fixed Carbon	51.48
Ash	11.32
Total	100.00
Sulphur	3.01
Phosphorus	0.032

Ultimate Analysis.	Per cent.
Carbon	72.82
Hydrogen	4.81
Oxygen	6.82
Nitrogen	1.22
Sulphur	3.01
Ash	11.32
Total	100.00

Calorimeter B. T. U. 13,412
Calculated B. T. U. 13,169

$$\text{Fuel ratio} = \frac{\text{Carbon}}{\text{Oxygen} + \text{Ash}} = \frac{72.82}{6.82 + 11.32} = 4.01$$

The above results reveal a very good quality of coal, comparing favorably both in calorific value and fuel ratio with the Washington bed of the Dunkard series in Doddridge county; in fact, both favor the Harlem bed.

Passing southwest in the same district to the Baltimore & Ohio railroad grade, one-fifth mile west of Bridgeport station, we find the Harlem coal cropping at an elevation of 980′ A. T., aneroid. The following section was measured at this point:

Opening No. 88 on Map.

		Feet.	Inches.
1.	Limestone, Lower Ames, fossiliferous	2	6
2.	Shale, dark	0	6
3.	Coal, good, Harlem	1	10
4.	Fire clay shale	2	0
5.	Shale to railroad grade	3	0

The writer collected a sample for analysis of the coal—No. 3 of section—the composition of which is reported by Prof. Hite as follows:

Proximate Analysis.	Per cent.
Moisture	0.95
Volatile Matter	36.52
Fixed Carbon	52.32
Ash	10.21
Total	100.00
Sulphur	4.09
Phosphorus	0.008

Ultimate Analysis.	Per cent.
Carbon	74.02
Hydrogen	4.66
Oxygen	5.94
Nitrogen	1.08
Sulphur	4.09
Ash	10.21
Total	100.00

Calorimeter B. T. U. 13,562
Calculated B. T. U. 13,344

$$\text{Fuel ratio} = \frac{\text{Carbon}}{\text{Oxygen} + \text{Ash}} = \frac{74.02}{5.94 + 10.21} = 4.58$$

In the same district, Mr. Reger, collected a sample for analysis from the same bed, and measured the following section at an opening on the Cornell and Lang farm near the electric railroad grade, 0.7 mile southwest from Bridgeport station at an elevation of 1050′ A. T., aneroid:

Opening No. 89 on Map.

		Feet.	Inches.
1.	Limestone, fossiliferous, Lower Ames...	0	10
2.	Shale, sandy top, dark gray bottom.....	10	0
3.	Coal, good Harlem......................	1	6
4.	Fire clay..............................	1	6
5.	Limestone, silicious, gray, broken, Ewing to railroad grade....................	5	0

The sample was collected from No. 3 of section, the composition and calorific value of which is reported by Prof. Hite as follows:

Proximate Analysis.

	Per cent.
Moisture	0.84
Volatile Matter..........	35.71
Fixed Carbon.............	51.45
Ash	12.00
Total..................	100.00
Sulphur	4.05
Phosphorus	0.034

Ultimate Analysis.

	Per cent.
Carbon	71.00
Hydrogen	4.78
Oxygen	6.90
Nitrogen	1.27
Sulphur	4.05
Ash	12.00
Total..................	100.00

Calorimeter B. T. U...........................13,135
Calculated B. T. U............................12,921

$$\text{Fuel ratio} = \frac{\text{Carbon}}{\text{Oxygen} + \text{Ash}} = \frac{71.00}{6.90 + 12.00} = 3.76$$

Passing eastward along the B. & O. R. R. grade from Bridgeport to a cut one-half mile southeast from Oral, we find 18 inches of the Harlem coal, according to Mr. Reger, cropping at an elevation of 1050′ A. T., aneroid, 4 feet below the Lower Ames limestone.

Southwest from Oral 1.2 miles in the same district on Davisson run, we find the following section exposed on the south side of the latter stream, just west of the axis of the Chestnut Ridge anticline:

	Feet.	Inches.
Limestone, fossiliferous, Lower Ames	2	0
Shale, dark	10	0
Coal, Harlem	0	6
Fire clay shale	5	0
Sandstone, shaly	20	0
Concealed	30	0

(Elevation of coal, 1085′ A. T., aneroid).

Southeastward three-fourths mile the coal has thickened up to 12 inches at an exposure near a road fork.

In the southern portion of Simpson district, the Harlem coal crops along the hill road leading northwest from the residence of Chas. J. Roy, 2.2 miles northeast of Quiet Dell, where the following section was measured:

	Feet.	Inches.
Limestone, shaly, fossiliferous, Lower Ames	2	0
Shale, dark gray	10	0
Coal, good, Harlem	1	6
Fire clay.		

(Elevation of coal, 1070′ A. T., aneroid).

One-half mile southeastward the same thickness of Harlem coal is exposed at the fork of the second class road.

In Elk district the Harlem coal attains about the same thickness and character as in Simpson. In the northern part of the former area, this bed crops at the triangle of roads, 1.4 miles southeast from Quiet Dell, at an elevation of 1135′ A. T., aneroid. Here the coal is 18 inches thick, coming 10 feet below the Lower Ames limestone.

Near the western border of Elk the following section was measured at the crop of this coal along the road, one-half mile northwest of the Arthur Conley No. 1 gas well (736), near the head of Hastings run:

				Feet.	Inches.
Limestone, fossiliferous, Lower Ames				0	6
Shale, dark green and sandy				5	0
Coal	0′	3½″	**Harlem**	1	6½
Slate, black	0	3			
Coal	1	0			
Fire clay.					

This exposure is an exception, in that the Harlem bed does not usually have a parting slate.

Near the central portion of Elk district Mr. Reger obtained the following section at an exposure of this coal on the south side of Stevens run, one mile southwest from Craigmoor, 0.2 miles southward from the A. H. Davisson No. 1 gas well (737):

	Feet.	Inches.
Sandstone, gray, medium grained, Grafton..	20	0
Concealed	10	6
Coal, good, Harlem........................	2	6
Shale, brown.................................	5	0
Limestone, good, Ewing....................	4	0

(Elevation of coal, 1125′ A. T., aneroid).

The section shows the maximum thickness of the coal observed at this horizon in Harrison county.

Slightly over a mile southward on Rooting creek, Mr. Reger obtained a sample of the Harlem coal for analysis, and measured the following section at an exposure along the road northeast from a school house, on the land of Isaac Maxwell:

Isaac Maxwell Opening, No. 91 on Map.

	Feet.	Inches.
1. Shales, greenish brown.................	10	0
2. Limestone, hard, blue, Lower Ames.....	0	6
3. Slate, dark gray........................	2	0
4. **Coal, good, Harlem**......................	2	0
5. Shale, limy to road.....................	3	0

(Elevation of coal, 1050′ A. T., aneroid).

Sample taken from No. 4 of section, the composition of which is reported by Prof. Hite as follows:

Proximate Analysis.

	Per cent.
Moisture	5.99
Volatile Matter...........	32.34
Fixed Carbon.............	50.59
Ash	11.08
Total..................	100.00
Sulphur	1.60
Phosphorus	0.036

Ultimate Analysis.

	Per cent.
Carbon	63.88
Hydrogen	4.84
Oxygen	17.48
Nitrogen	1.12
Sulphur	1.60
Ash	11.08
Total..................	100.00

Calorimeter B. T. U..........................11,148
Calculated B. T. U..........................10,947

$$\text{Fuel ratio} = \frac{\text{Carbon}}{\text{Oxygen} + \text{Ash}} = \frac{63.88}{17.48 + 11.08} = 2.24$$

The low B. T. U. and fuel ratio results are due to the excessive amount of oxygen in the sample as revealed in the ultimate analysis. The sample was collected directly on the crop where more or less weathering had taken place; hence, the high oxygen content.

In Grant district, the Harlem coal appears to have about the same thickness and character, except in the southwest corner, as it does in Elk and Simpson. In the southeastern part of the district this coal crops in the road one-half mile southwest from Rockford, at an elevation of 130′ A. T., aneroid. Here it is 22 inches thick without partings.

Near the center of the district, Mr. Reger collected a sample of this coal and measured the following section at its crop in the road on the land of Isaac Maxwell, 0.2 mile northwest from Lost Creek railroad station:

Isaac Maxwell Opening, No. 90 on Map.

		Feet.	Inches.
1.	Shale, brown and ferriferous	10	0
2.	Limestone, fossiliferous, Ames	1	0
3.	Slate	3	0
4.	Coal, good, Harlem	2	6
5.	Shale, yellow, to road	4	0

The sample was collected from No. 4 of section, the composition of which is reported by Prof. Hite as follows, along with the average of the first three out of the five above samples of Harlem coal analyzed from Harrison county:

Proximate Analysis.

	Opening No. 90 Per cent.	Average 3 Samples. Per cent.
Moisture	7.01	0.83
Volatile Matter	37.95	36.24
Fixed Carbon	42.68	51.75
Ash	12.36	11.18
Totals	100.00	100.00
Sulphur	1.37	3.17
Phosphorus	0.038	0.024

Ultimate Analysis.

	Opening No. 90 Per cent.	Average 3 Samples. Per cent.
Carbon	59.43	72.61
Hydrogen	4.12	4.75
Oxygen	21.69	6.55
Nitrogen	1.03	1.19
Sulphur	1.37	3.72
Ash	12.36	11.18
Totals	100.00	100.00

	Opening No. 90 Per cent.	Average 3 Samples. Per cent.
Calorimeter B. T. U.	10,226	13,370
Calculated B. T. U.	9,574	13,145
Fuel ratio $= \frac{\text{Carbon}}{\text{Oxygen} + \text{Ash}} =$	1.75	4.12

This sample (No. 90) contains an even higher percentage of oxygen than that from No. 91 on Rooting creek, and the same conditions are probably responsible for the low B. T. U. and fuel ratio results as at the latter opening. The average of the three samples of Harlem coal compares favorably with the Pittsburgh bed as exhibited in the table of coal analyses on a subsequent page.

Passing to the southwest corner of Grant district, we find the Harlem coal cropping 0.2 mile eastward from the mouth of Bens run of Hackers creek, at an elevation of 1030′ A. T., aneroid. Here it is only 10 inches thick, coming 3 feet below the Lower Ames limestone. Its crop is exposed along the road, 0.7 miles eastward from the mouth of Kincheloe creek, at an elevation of 1085′ A. T., aneroid. Here it is only 3 inches thick, coming immediately below the Lower Ames limestone.

A further discussion of the character and quantity of this coal available in the Doddridge-Harrison area will be given in a subsequent chapter of this report.

The Ewing Limestone.

At 1 to 10 feet below the Harlem there sometimes occurs a calcareous stratum, 1 to 5 feet thick, that has been named by Ohio geologists the **Ewing limestone.** It appears to be of fresh or brackish water origin in West Virginia, since it does not contain marine fossils.

This limestone lies entirely below drainage in **Doddridge** county.

In **Harrison** it crops over practically the same area as that outlined for the Ames limestones. Its relative position in the rock column is exhibited in the section given for Romines Mills, page 126.

In Simpson district this stratum crops along the grade of the electric railroad, 0.7 mile southwest from Bridgeport, at an elevation of 1045′ A. T., aneroid. Here it is gray, silicious, and 5 feet thick, coming 18 inches below the Harlem coal and 13 feet below the Lower Ames limestone.

In the northern part of Elk district the following was measured at its crop along the public highway, 0.8 mile northeast from Quiet Dell:

	Feet.	Inches.
Limestone, fossiliferous, Lower Ames, thickness not exposed	..	..
Shale, dark	10	0
Coal, Harlem	1	6
Fire clay shale	5	0
Limestone, gray and hard, with minute fresh water fossils, Ewing	2	0

Near the central portion of Elk district Mr. Reger collected a sample of this limestone for analysis, and measured the following section at its crop on Stevens run, one mile southwest from Craigmoor:

	Feet.	Inches.
Coal, good, Harlem	2	6
Shales, brown	5	0
Limestone, Ewing	4	0

Prof. Hite reports the following composition for the sample of limestone collected at this place:

	Per cent.
Silica ($Si\ 0_2$)	11.72
Ferric Iron (Fe_20_3)	2.57
Alumina (Al_20_3)	8.99
Calcium Carbonate ($Ca\ C0_3$)	68.96
Magnesium Carbonate ($Mg\ C0_3$)	3.65
Phosphoric Acid (P_20_5)	0.29
Loss on ignition	4.76
Total	100.94

The results reveal a ledge adapted to the manufacture of hydraulic cement, hydrated lime for agricultural purposes, and road material.

The crop of the Ewing limestone was observed at only one point in Grant district. This is where it rises out of West Fork river at Goodhope, as exhibited by the following section:

	Feet.	Inches.
Fire clay shale	6	0
Limestone, gray and hard, conglomeratic and nodular at top, massive at bottom, Ewing	5	0
Sandstone to river bed	5	0

While not so thick and persistent as the Clarksburg limestone, yet the Ewing should furnish an abundant supply of road material for the localities near the above mentioned exposures.

The Pittsburgh Red Shale.

Immediately below the Ewing limestone in northern West Virginia there occurs a soft, red or purple, and variegated shale, ranging in thickness from 30 to 100 feet, that has been designated the **Pittsburgh Red Shale** from their crop near the city of that name in Pennsylvania. This band of reds is nearly always recorded by the drillers for oil and gas, and is usually called by them the "Big Red Cave" on account of their caving tendencies when penetrated by the drill. Great care has to be exercised in drilling through these reds to avoid losing the drilling tools.

In **Doddridge** county these shales lie entirely below drainage, but their thicknesses are recorded in the logs of the borings used in connection with the sections for Centerpoint, Canton, and Greenwood, pages 72, 75 and 80, respectively

In **Harrison** these reds are recorded in the borings used in connection with the sections for Salem, West Milford, Boothsville, and Romines Mills. The shale crops over a large portion of the area outlined for the crop of the Ewing limestone in this county. Eastward from Bridgeport the reds have apparently been replaced by sandstone near Oral. The shales quite generally contain nuggets of limestone, and for that reason add to the fertility of the soil wherever they come above drainage.

The Saltsburg Sandstone.

The basal portion of the Pittsburgh Red Shale is frequently replaced by a massive sandstone that attains a thickness of 100 feet near Saltsburg, Penna., from which J. J. Stevenson has named it the **Saltsburg sandstone.**

In **Doddridge** county this stratum lies entirely below drainage, but its thickness is recorded in the log of the boring used in connection with section for Big Isaac, page 89.

In **Harrison** the crop of this sandstone is confined to the crest of the Wolf Summit anticline in the extreme southeast corner of Union district, and the southwest corner of Grant; and to the crest of the Chestnut Ridge anticline southwestward in Simpson, Elk and Clay districts. The thickness, character, and relative position of this stratum in the rock column in this county is exhibited in the sections given on preceding pages for Brown, Fonda S., Salem, Wyatt, Adamsville, Two Miles North of Clarksburg, and Byron.

In Simpson district the Saltsburg sandstone is elevated above drainage on Davisson run, 1.2 miles due south from Bridgeport, where it is quarried for building purposes on the property of Benjamin Stout. Here it is bluish gray and medium grained, the top of the quarry coming 50 to 60 feet below the horizon of the Harlem coal. The entire thickness of the sandstone is not exposed, only 15 feet being visible. The product is waggoned to Bridgeport where it gives excellent results on account of its durability in retaining walls and for foundations of buildings. The base of the quarry has an elevation of 1005′ A. T., aneroid. One-half mile eastward this stratum crops along the road on the north side of Davisson run near the axis of the Chestnut Ridge anticline. Here it is pebbly and massive, coming 40 feet below the Harlem coal. The top has an elevation of 1050′ A. T., aneroid.

In the eastern edge of the same district, D. B. Reger reports a very hard, massive and gray sandstone cropping in the Baltimore & Ohio railroad cut, one-half mile eastward from Oral station, at an elevation of 1025′ A. T., aneroid. This stratum may correlate with the Saltsburg sandstone, but if so, the Pittsburgh Red Shale has thinned away almost entirely, as revealed by the following section, measured by Mr. Reger:

	Feet.
Limestone, Lower Ames	1
Shale, gray	4
Coal, Harlem	1½
Shale, brown, limy, fossiliferous	10
Sandstone, (Saltsburg?)	20

Mr. Reger reports the sandstone undergoing a transformation in character in this cut within a distance of 300 to 400 feet, changing from a hard massive rock to a shaly stratum; hence, it may represent only a local replacement of the reds by sandstone, and not the Saltsburg.

In the northern part of Elk district this sandstone is elevated above drainage on Brushy fork, one-half mile northeast from Quiet Dell, at the highway bridge over the latter stream. Here 15 feet of the basal portion is visible, coming immediately over 10 inches of Bakerstown coal, and 60 feet below the Harlem coal. The elevation of the sandstone at this point is 975′ A. T., aneroid.

Passing southward in the same district 2 miles, we find it cropping in the road one-fourth mile northwest from the mouth of Fall run, at an elevation of 1055′ A. T., aneroid. Here it is coarse, massive, and 15 feet thick, coming 2 feet over 60 inches of Bakerstown coal, and 55 to 60 feet below the Harlem coal. One mile southward, Mr. Reger reports 20 feet of hard pebbly sandstone at this horizon along the road on Hastings run, 0.7 mile west of Craigmoor, coming immediately over 1 foot of Bakerstown coal, at an elevation of 1040′ A. T. spirit level.

In Grant district the Saltsburg sandstone is raised above drainage by the Chestnut Ridge anticline on Lost creek in Rockford, at an elevation of 1070′ A. T., aneroid. Here it is coarse, brown, massive, and 40 feet thick, coming immediately over the Bakerstown coal.

In the extreme southeast corner of Union district the Saltsburg makes vertical cliffs, 20 to 30 feet high, just above water level at the mouth of Kincheloe creek, offering fine exposures for quarrying purposes.

The Bakerstown Coal.

At 1 to 10 feet below the Saltsburg sandstone and 75 to 100 feet below the Ames limestone there occurs a coal bed that often attains minable thickness in West Virginia. This vein has been designated the **Bakerstown coal** by I. C. White[7] from a town of that name in Allegheny county, Penna., near which it has been mined.

In **Doddridge** this coal lies entirely below drainage, and according the the logs of numerous wells bored for oil and gas, the bed does not attain merchantable thickness and regularity in the county. Its thickness is recorded as 2 feet in the log of the Wm. Flanagan No. 1 well (198), used in connection with the Greenwood section, page 80.

In **Harrison** the crop of the Bakerstown coal is confined to the immediate vicinity of the Chestnut Ridge anticline where the latter fold is intersected by Simpson creek, Brushy fork, Elk creek, and Lost creek. Its relative position in the rock column in this county is exhibited in the sections given on preceding pages for Goodhope, Wilsonburg S., Two Miles North of Clarksburg, and Lost Creek.

In Simpson district, the only place the crop of the Bakerstown coal was observed was at the road fork, one-half mile northwest of Oral station. Here, according to Mr. Reger, it is only 1 inch thick, coming 85 to 90 feet below the Harlem coal. Its elevation at this place is 1005′ A. T., aneroid.

Passing southwestward to the northern part of Elk district, we find this coal cropping one-half mile northeast of Quiet Dell near the bridge over Brushy fork, at an elevation of 975′ A. T., aneroid. Here the following section was measured:

	Feet.	Inches.
Sandstone, massive, Saltsburg	15	0
Coal, Bakerstown	0	10
Concealed		

The coal comes 75 to 80 feet below the crop of the Harlem coal in the road to the northeast.

---

[7] Report Q, Second Geol. Survey, Penna

Two miles southward, the coal crops in the road, one-fourth mile northwest from the mouth of Fall run at an elevation of 1055′ A. T., aneroid, coming 80 feet below the Harlem bed. Here the following section is exposed:

	Feet.	Inches.
Sandstone, massive, coarse, Saltsburg......	15	0
Concealed	2	0
Coal, Bakerstown..........................	0	6
Fire clay shale..........................		

Near the central part of Elk district, Mr. Reger reports 12 inches of Bakerstown coal on the south side of Hastings run, 0.7 mile westward from Craigmoor, at an elevation of 1040′ A. T., spirit level. Here the bed is overlaid directly by 20 feet of massive and pebbly sandstone (Saltsburg).

In Grant district the Bakerstown coal crops along the road on Lost creek at Rockford, at an elevation of 1070′ A. T., aneroid. Here the following section was measured:

	Feet.	Inches.
Sandstone, coarse, brown, massive, Saltsburg	40	0
Coal, Bakerstown..........................	0	6
Fire clay, concealed and massive sandstone, pebbly, Buffalo, to creek bed...........	35	0

One-half mile northwest from Rockford, this coal crops in the road at an elevation of 1055′ A. T., aneroid. Here it is only 6 inches thick. It is this coal that crops at the road fork at an elevation of 1080′ A. T., spirit level, 0.6 mile southeast of Rockford. There it is less than one foot thick.

As in Doddridge, the Bakerstown coal is thin, irregular and worthless in Harrison county.

The Pine Creek limestone of I. C. White was not observed at any point where its horizon is elevated above drainage in Harrison county.

The Buffalo Sandstone.

At 10 to 30 feet below the Bakerstown coal in northern West Virginia there occurs a massive, arenaceous, and pebbly stratum that has been named the **Buffalo sandstone** by I. C. White[8] from a stream of that name along which it crops in Butler county, Penna. It is this stratum that correlates with the First Cow Run oil sand of Cow Run, Ohio, and the Little Dunkard sand of eastern Greene county, Penna.

In **Doddridge** county the Buffalo sandstone lies deeply buried below drainage, but its thickness is recorded in the logs of the borings used in connection with the sections for Canton and Greenwood, pages 75 and 80, respectively.

In **Harrison** county the crop of the Buffalo is confined to near the crest of the Chestnut Ridge anticline where the latter fold is crossed by Elk and Lost creeks. Its thickness and relative position in the rock column are exhibited in the sections given on preceding pages for Deweytown, West Milford, Goodhope, Lumberport, Boothsville, Wilsonburg, and Two Miles North of Clarksburg.

In Elk district it is this stratum that crops at the road fork at the mouth of Fall run, three-fourths mile northwest from Craigmoor, at an elevation of 1000′ A. T., aneroid. Here it is coarse, brown, massive, and pebbly, forming large boulders. Its total thickness is not exposed.

In Grant district this sandstone makes the shoals in Lost creek at Rockford. No quarries were observed on this ledge in the county.

The **Brush creek limestone, Brush creek coal,** and **Mahoning sandstone** do not get above drainage in the Doddridge-Harrison area. The horizon of the latter, however, is recorded in the logs of the borings used in connection with the sections given on preceding pages for Canton, Long Run, Greenwood, and Big Isaac for Doddridge county; and for Brown, Fonda, Deweytown, West Milford, Benson, Lumberport, Adamsville, Bridgeport, and Romines Mills.

---

[8] Report Q, Penna. Geol. Survey.

PART III.

The Mineral Resources of the Doddridge-Harrison Area.

CHAPTER VIII.

PETROLEUM AND NATURAL GAS.

All the oil and gas yet discovered in West Virginia, with one or two exceptions, has been produced from sandstone beds, called "sands" by the well drillers. The latter have given these sands various names which have come into general use. In northern Calhoun and northeastern Roane counties, the Greenbrier limestone, or "Big Lime" of the drillers, has produced some dark, heavy oil. This is the only calcareous stratum that has produced either oil or gas in the State. The following table, taken from pages 278 and 279 of the Wirt-Roane-Calhoun Report of the State Survey, exhibits the position of the several sands, or oil and gas bearing horizons in West Virginia:

The Oil and Gas Horizons of West Virginia.

Carboniferous.	**Monongahela Series**	Carroll sand (Uniontown).
	Conemaugh Series	Minshall (Connellsville). Murphy (Morgantown). Moundsville (Saltsburg). First Cow Run (Little Dunkard) sand (Buffalo). Big Dunkard sand (Mahoning).
	Allegheny Series	Burning Springs (Upper Freeport) sand. Gas sand (Lower Freeport).
	Pottsville Series	Gas sand of Marion and Monongalia counties (Homewood), Second Cow Run of Ohio. Gas sand of Cairo. Salt sand of Cairo. Cairo?
	Mauch Chunk Red Shale	Maxton, Dawson, Cairo.
	Greenbrier Limestone	"Big Lime"; not generally productive.
	Pocono Sandstones	Keener sand and Beckett sand of Milton. Big Injun sand. Squaw sand. Berea Grit.
Devonian.	**Catskill Red Beds**	Gantz sand. Fifty-foot sand. Thirty-foot sand. Stray sand. Gordon sand. Fourth sand. McDonald or Fifth sand. Bayard or Sixth sand. Elizabeth or Seventh sand.
	Chemung and Portage Beds	Warren First or Second Tiona, Speechley sand. No well defined oil or gas horizons yet discovered in West Virginia.

Oil and gas in paying quantities have been found in the Doddridge-Harrison area in the Moundsville (Saltsburg) sand just below the middle of the Conemaugh series, down through the rock column to and including the Bayard or Sixth sand near the base of the Catskill measures. Although the Chemung and Portage rocks have been penetrated by two or three deeps wells within the boundaries of the two counties, yet no producing horizons were encountered by the drill. The following sands have produced either oil or gas in the area under discussion: Moundsville, First Cow Run, Big Dunkard, Second Cow Run, Salt, Maxton, Big Lime, Keener, Big Injun, Berea, Gantz, Fifty-foot, Thirty-foot, Gordon Stray, Gordon, Fourth, Fifth or McDonald and Bayard or Sixth.

In this portion of the State the sands are generally referred to the Pittsburgh coal bed as the key rock to determine their identity. This coal is absent from the measures in the western part of Doddridge county, but the following table gives a general idea of the sequence or order of the beds and approximate distance from the Pittsburgh coal horizon down to the top of the producing sands in both counties:

Approximate Distance from Pittsburgh Coal to Top of Oil and Gas Sands in Doddridge-Harrison Area.

Sand.	Distance Feet	Sand.	Distance Feet
Moundsville (Saltsburg)	350	Big Injun	1450
First Cow Run (Little Dunkard)	420	Berea Grit	1850
Big Dunkard (Mahoning.)	475	Gantz	1930
Second Cow Run (Homewood)	800	Fifty-foot	1980
Salt (Connoquenessing)	900	Thirty-foot	2030
Maxton	1200	Gordon Stray	2070
Big Lime (Greenbrier)	1300	Gordon	2100
Keener	1400	Fourth	2160
		Fifth or McDonald	2325
		Sixth or Bayard	2450

Owing to the rapid thickening up of the Pottsville and Mauch Chunk measures to the south and east, the above intervals for the sands below the Second Cow Run are only approximate. For instance, the interval from the top of the Pittsburgh coal to the top of the Big Injun sand in the A. J. Ashcraft No. 1 well (6), located on the head of Sycamore fork in the northeastern Doddridge, is 1276 feet as opposed to 1600 feet for the same interval at the A. H. Davisson No. 1 well (737), located one mile northwest from Romines Mills, in southeastern Harrison county. Hence, it is readily observed that no specific figures can be given for intervals to these sands below any key rock that will hold good over the entire area of both counties.

DESCRIPTION OF SANDS.

The Moundsville Sand.

In the vicinity of Moundsville, Marshall county, there occurs an oil pool in a sand 300 to 325 feet below the Pittsburgh coal. This sand was formerly thought to represent the First Cow Run sand of Washington county, Ohio, but the writer shows on pages 281-285 of the Wirt-Roane-Calhoun Report of the State Survey that the latter sand correlates with the Buffalo sandstone of the Conemaugh series, and not the Saltsburg; hence, the name **Moundsville sand** has been applied to the oil producing horizon at the place first mentioned.

In the Doddridge-Harrison area this stratum has produced oil at only one point; viz., in the Malissa Kelley No. 1 well (328), located on a branch of Elk creek in Sardis district, Harrison county, 2.4 miles northeast from Wallace. The well had an initial production of 7 to 8 barrels 5 feet in a sand the top of which comes 352 feet below the top of the Pittsburgh coal bed, according to the log furnished by the owners, the South Penn Oil Company. Here the sand was reported 38 feet thick.

The First Cow Run (Little Dunkard) Sand.

At 420 to 425 feet below the Pittsburgh coal, and 110 to 125 feet below the Ames limestones there occurs a gas and oil producing stratum that has been designated by the well drillers the **First Cow Run sand** from a stream of that name in Washington county, Ohio, where it has produced much oil. On pages 281-285 of the Wirt-Roane-Calhoun report, the writer shows that this sand correlates with the Buffalo and not the Saltsburg of the Conemaugh series, and that the Little Dunkard sand of eastern Greene county, Pa., comes at the same horizon. The first name holds, however, by right of priority.

In the Doddridge-Harrison area a show of oil was encountered at this horizon in only one locality. This was in the B. F. Rogers No. 2 well (352), situated in the northwestern edge of Sardis district, 1.4 miles westward from Rinehart. Here the top of the sand comes 439 feet below the Pittsburg coal. The sand is 70 feet thick. The oil pay occurred 10 feet in the sand.

The Big Dunkard Sand.

At 475 to 500 feet below the Pittsburgh coal there occurs what is known as the **Big Dunkard sand** of the drillers, so named from Dunkard creek in eastern Greene county, Penna., where it produced much oil in the early days of the petroleum industry. It correlates with the Mahoning sandstone of the Conemaugh series.

In the Doddridge-Harrison area this sand has produced oil at two localities. One is at the Lewis Maxwell No. 2 well (173), of the Acme Carbon Company, located in West Union district, Doddridge county, on Left fork of Arnolds creek 4½ miles southward from West Union. Here a four barrel oil well was struck 6 feet in a sand, the top of which comes 512 feet below the Pittsburgh coal bed. The other is at the I. L. Marsh No. 1 well (373), located at the northwest edge of Brown, Harrison county, where an 8 to 10 barrel daily well was encountered 15 feet below the top of the Big Dunkard sand, the latter coming 512 feet below the Pittsburgh coal. The oil was never pumped, but much of it was utilized by farmers of that region.

The Second Cow Run Sand.

At 800 to 850 feet below the Pittsburgh coal, and 525 to 550 feet below the Ames limestones there occurs the **Second Cow Run sand** of the drillers that has been so designated from a stream of that name in Washington county, Ohio, along which it produced a large amount of oil, 50 years ago. On pages 287-290 of the Wirt-Roane-Calhoun Report of the State Survey, the writer demonstrates conclusively that this sand correlates with the Homewood sandstone at the top of the Pottsville series.

In the Doddridge-Harrison area small gas flows in this sand have been encountered in at least two wells. The first of these is the C. G. Davis No. 1 well (116), located in Grant district, Doddridge county, one mile south 80° east from Doak. Here a small flow of gas was struck in a sand, the top of which comes 810 feet below the top of the Pittsburgh coal bed. The other well is known as the Acena Copenhaver No. 1 boring (540), located in the western point of Eagle district, one mile southwest of Margaret. Here the gas pay was struck at a depth of 845 feet below the Pittsburgh coal, and 100 feet in the sand.

The Salt Sand.

The **Salt sand** of the drillers occurs 900 to 1050 feet below the Pittsburgh coal. It is often separated into three ledges, and is then called the First, Second and Third Salt sand. It constitutes the main portion of the Pottsville series, and in West Virginia has produced a large amount of both oil and gas.

In Doddridge county this sand produced a small flow of gas in Grant district at Sherwood in the Tate Bros. (120), Orrowhood (121), and Stutler (128) wells. This sand is gas bearing in West Union district on Left fork of Arnolds creek, 4 miles southward from West Union in the Lewis Maxwell wells (173 and 174) of the Acme Carbon Company.

In Harrison county the Salt sand does not appear to be productive of either oil or gas.

The Maxton Sand.

The Maxton sand of Tyler county belongs in the Mauch Chunk series, a short distance above the Greenbrier limestone or "Big Lime" of the drillers. This stratum has produced oil in several counties of the State, but the most productive field at this horizon is found near Burton in the northeast corner of Wetzel county.

In **Doddridge county** this sand has produced oil in the western portion of Grant district and gas in the southern portion of the same district in wells Nos. 107 and 119. In Center district wells Nos. 198 and 220 produced gas from this stratum, and No. 204 made some oil from the same horizon. In Southwest district it is this sand and not the Big Injun as published in Vol. I, pages 321-322 of the State Survey reports, in which the small flow (less than one barrel daily) of oil was struck in a sand, the top of which comes only 1170 feet below the horizon of the Pittsburgh coal. In this region the top of the Big Injun sand comes 1350 to 1376 feet below the Pittsburg coal as exhibited by other wells in the vicinity in the table of wells given on a subsequent page for Doddridge county.

In **Harrison county** the S. S. Cross No. 1 well (461) on the east bank of Raccoon run, 1.3 miles south of Bristol, produces its oil from the Maxton sand, having an initial production of 10-12 barrels daily. Near Olive it is an important gas horizon. A show of gas in the Maxton was struck in the Copeland Heirs No. 1 well (453), located one mile southwest of Wolf Summit. In the western portion of Grant district, a flow of gas was encountered in this stratum in the Mary J. Burnside No. 1 well (728), located one mile southward from Goodhope.

The Big Lime.

The Greenbrier limestone or "Big Lime" of the drillers has produced both oil and gas in Doddridge county. In West Union district a light flow of gas was struck near the top of this stratum in the J. Wesley Smith No. 1 well (178), located 1¾ miles northeast of Nay. A two barrel oil well was struck in the top of the same formation in the Ed Smith No. 1934 well (181), located 3¼ miles south of Central Station. In Central district a light gas flow was encountered in the Big Lime in the W. A. Duckworth No. 1 well (188), located 1 mile southwest of Central Station, and in the Jack Cunningham No. 1 well (205), located two miles north of Nay.

The Big Injun Sand.

The Big Injun sand comes immediately under the Greenbrier limestone or "Big Lime" and for that reason is the easiest stratum to be identified by the well drillers in West Virginia. In the northern portion of the State this sand attains a thickness of 300 feet. Frequently the uppermost 30 to 40 feet is separated from the main bed by 5 to 15 feet of dark slate as in the southwest end of the Sistersville oil field of Tyler county, where this top portion was designated by the drillers the **"Keener sand"** from a farm of that name on which the first oil well at this horizon was obtained. Sometimes the bottom portion of the Big Injun is separated from the main bed by a band of slate 15 to 25 feet thick, and this basal portion is then called the **"Squaw sand."**

The depth and thickness of the Big Injun sand is exhibited in the table of wells for each county, given on subsequent pages of this report. The same tables show that this horizon is one of the most important oil and gas producers in the Doddridge-Harrison area.

The Berea Grit.

The Berea Grit formation, coming 475 to 525 feet below the top of the Big Lime, appears to be the basal member of the Pocono sandstone group, and has been so classified by the writer in the general sections of the rocks as given in Chapter IV. It is the great gas horizon west of Spencer, Roane county, and oil horizon on Lee run, same county, and on Rowles run and Yellow creek, Calhoun county. The "Fink pool" of Lewis county, in the writer's judgment, belongs in the Berea and not in the Gantz sand, coming as it does 450 to 500 feet below the top of the Big Lime. The latter pool overlaps to the northwest in **Doddridge county,** as exhibited by wells 248 and 249 southwest of St. Clara and 278 south of Coldwater. In southwest district a show of gas was struck in the Berea in the David W. Gray No. 2 well, one-half mile southeast from Oxford.

In **Harrison county** a light flow of gas was struck in this sand in the Jas. Coffman No. 1 well, located 2 miles northwest of Peora in Eagle district. In the vicinity of Lost Creek station, Grant district, the Berea and not the Gantz as given by the drillers is a very prolific gas horizon.

The Gantz Sand.

The Gantz sand is the next oil and gas horizon below the Berea Grit. In the area under discussion this sand comes 1900 to 1950 feet below the Pittsburgh coal. It was so named from a well on the Gantz[1] farm at Washington, Penna., that was drilled in the year 1885. At this well the sand comes 1827 feet below the Pittsburgh coal. In northeastern Wetzel county the log of the Sarah Anderson[2] No. 1 well, located one mile northeast of Burton, shows the same sand coming 1951 feet below the top of the Pittsburgh coal, 160 feet below the Berea sand and 34 feet below 15 feet of **red shale.** The latter is evidence that the Gantz belongs in the Catskill reds. It is the top portion of the **Hundred-foot sand** of Butler county, Penna.

No producing wells were observed at this horizon in Doddridge county. In **Harrison,** however, this sand has produced gas in Union, Clark and Grant districts. The table of wells for the latter county exhibits the points where this sand is productive.

The Fifty-foot Sand.

The Fifty-foot sand closely underlies the Gantz, the two often combining into a great sand mass 100 or more feet in thickness, known as "Hundred-foot" of Butler, Armstrong, and Beaver counties, Penna. Its interval below the Pittsburgh coal in the Doddridge-Harrison area varies from 1950 to 2000 feet. The sand does not appear to be oil and gas bearing in **Doddridge** county.

In **Harrison,** however, this sand has been a prolific gas horizon in Sardis, Ten Mile, Union. Eagle, Clay, Coal, and

---

[1] Bull. No. 304, U. S. Geol. Survey.

[2] Marshall-Wetzel-Tyler Report, p. 110, W. Va. Geol. Survey; 1909.

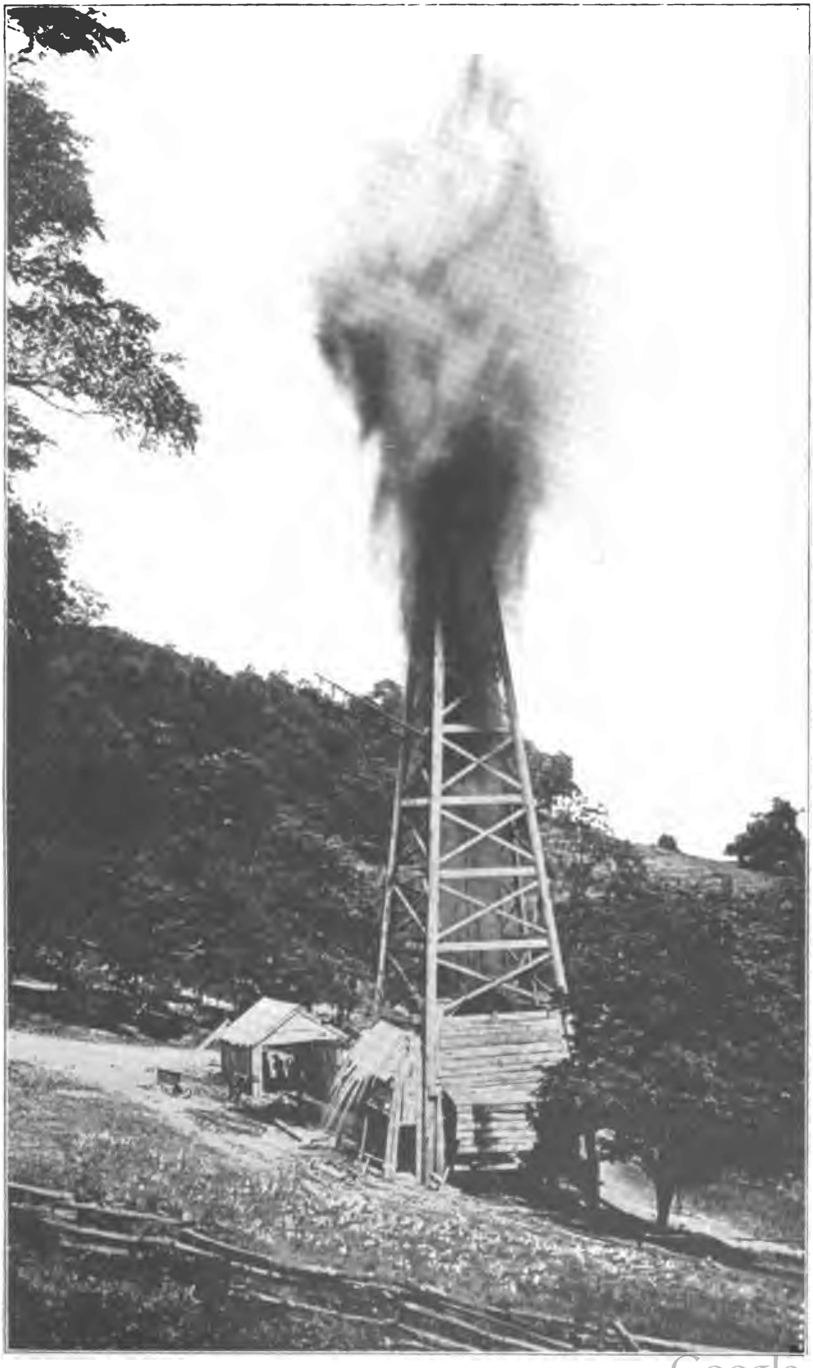


PLATE VIII.—Effect of Shot on a Fifty-foot sand Oil Well in Shinnston pool—Hartley Heirs No. 1 well.

Simpson districts. In Clay district the great Shinnston oil pool occurs in this sand. In fact, the E. E. Swiger No. 2316 well (618), located ½ mile northwest of Adamsville, had the largest initial production—450 barrels an hour—of any well ever drilled in the State. In Simpson district, a small showing of oil was struck in this sand in the M. R. Lodge No. 1 well (683), located on Barnett run, 2 miles northward from Bridgeport.

The Thirty-foot Sand.

The Thirty-foot sand is the next oil and gas horizon bebelow the last above described. It ranges from 2000 to 2050 feet below the Pittsburgh coal in the area under discussion.

In **Doddridge county** this sand does not appear very productive of either oil or gas. In **Harrison**, however, it has produced both in considerable amounts. In the northeastern corner of Eagle district, it is in this sand that oil production is found in the Serena Wyer No. 1 well (535) near Margaret, others to the east and northeast on the Morris, and Moore farms. In the Wyer well (535), this sand comes 1988 feet below the Pittsburgh coal, 36 feet below the Fifty-foot, and 69 feet above the Gordon Stray sand. This is the only portion of the area that the Thirty-foot has proved oil bearing, although producing more or less gas in almost every district in Harrison county.

The Gordon Stray Sand.

The Gordon Stray sand comes a short distance below the **red shale** separating it from the Thirty-foot above and 5 to 40 feet above the Gordon sand. In the Doddridge-Harrison area this sand comes 2040 to 2090 feet below the Pittsburgh coal.

In northern **Doddridge** it is a great gas horizon, and it has produced some oil along the eastern border of McClellan district. One of the largest gas wells ever drilled in the State struck its flow of gas in this sand. This is the Camden Heirs No. 1 well (28), located in the southern point of McClellan district, one-half mile southwest of Cascara. There it comes

2054 feet below the Pittsburgh coal and 627 feet below the Big Injun sand.

In **Harrison county** this sand has been a great oil and gas producer in the western portions of Sardis and Ten Mile districts. It is also a prominent gas horizon in Union and Clay. As with all the Gordon group of sands, its correlation in this portion of the State is quite difficult, mainly on account of a lack of accurate, detailed records of wells from the Wetzel and Marion county lines southward across the area under discussion.

The Gordon Sand.

The Gordon sand is next in descending order below the Gordon Stray, underlying the latter 5 to 40 feet and ranging in thickness in the Doddridge-Harrison area from 1 to 60 feet. Its interval below the Pittsburgh coal in these two counties varies from 2075 to 2125 feet. The following table exhibits its maximum and minimum intervals below the top of the latter coal, and the top of the Big Injun sand by districts in each county as shown in the table of wells on subsequent pages of this report.

Table Showing Intervals in Feet of Gordon Sand Below Tops of Pittsburgh Coal and Big Injun Sand.

Map No.	County	District	Pittsburg Coal			Big Injun Sand		
			Max.	Min.	Ave.	Max.	Min.	Ave.
14	Doddridge	McClellan	2124	....	....	....	....	....
47	Doddridge	McClellan	....	2015	2064	....	....	....
41	Doddridge	McClellan	....	....	....	820	....	....
69	Doddridge	McClellan	....	....	....	....	703	761
106	Doddridge	Grant	2123	....	....	....	....	....
111	Doddridge	Grant	....	2054	2088	....	....	....
137	Doddridge	Grant	....	....	....	774	....	....
107	Doddridge	Grant	....	....	....	....	699	736
155	Doddridge	West Union	2143	....	....	....	....	....
181	Doddridge	West Union	....	1965	2054	....	....	....
155	Doddridge	West Union	....	....	....	733	....	....
176	Doddridge	West Union	....	....	....	....	619	676
198	Doddridge	Central	....	....	....	746	....	....
186	Doddridge	Central	....	....	....	....	709	727
225	Doddridge	Southwest	....	....	....	738	....	....
229	Doddridge	Southwest	....	....	....	....	602	670
243	Doddridge	Cove	....	....	....	730	....	....
241	Doddridge	Cove	....	....	....	....	587	608
275	Doddridge	New Milton	2139	....	....	....	....	....
277	Doddridge	New Milton	....	2118	2128	....	....	....
255	Doddridge	New Milton	....	....	....	770	....	....
277	Doddridge	New Milton	....	....	....	....	583	676
299	Doddridge	Greenbrier	2126	....	....	....	....	....
315	Doddridge	Greenbrier	....	2061	2093	....	....	....
296	Doddridge	Greenbrier	....	....	....	750	....	....
316	Doddridge	Greenbrier	....	....	....	....	585	667
378	Harrison	Sardis	2170	....	....	....	....	....
339	Harrison	Sardis	....	2055	2112	....	....	....
323	Harrison	Sardis	....	....	....	965	....	....
393	Harrison	Sardis	....	....	....	....	693	829
465	Harrison	Tenmile	2144	....	....	....	....	....
424	Harrison	Tenmile	....	2032	2138	....	....	....
400	Harrison	Tenmile	....	....	....	837	....	....
453	Harrison	Tenmile	....	....	....	....	637	737
510	Harrison	Union	2110	....	....	....	....	....
515	Harrison	Union	....	2057	2083	....	....	....
478	Harrison	Union	....	....	....	733	....	....
501	Harrison	Union	....	....	....	....	523	628
555	Harrison	Eagle	2190	....	....	....	....	....
534	Harrison	Eagle	....	2080	2135	....	....	....
536	Harrison	Eagle	....	....	....	871	....	....
593	Harrison	Eagle	....	....	....	....	675	773
603	Harrison	Clay	2206	....	....	....	....	....
603	Harrison	Clay	....	2206	2206	....	....	....
603	Harrison	Clay	....	....	....	786	....	....
615	Harrison	Clay	....	....	....	....	604	695
657	Harrison	Coal	2222	....	....	....	....	....
658	Harrison	Coal	....	2044	2133	....	....	....
657	Harrison	Coal	....	....	....	808	....	....
666	Harrison	Coal	....	....	....	....	650	729
676	Harrison	Clark	....	....	....	762	....	....
676	Harrison	Clark	....	....	....	....	630	696
685	Harrison	Simpson	....	....	....	702	....	....
682	Harrison	Simpson	....	....	....	....	595	648
725	Harrison	Grant	2302	2302	2302	....	....	....
718	Harrison	Grant	....	....	....	751	....	....
720	Harrison	Grant	....	....	....	....	635	693
734	Harrison	Elk	....	....	....	740	....	....
737	Harrison	Elk	....	....	....	....	712	726

In **Doddridge county** this sand is very prolific in both oil and gas. It has produced a large amount of oil along the eastern border of McClellan and Greenbrier districts; the northwest border of McClellan and Grant; and along the New Milton-Southwest district line in what it known as the "Stout Field." In the northern portion of the county it is a fine gas horizon along the crest of the Arches Fork anticline. In the southwest portion of the latter area this sand with others of the Gordon group appears to thin away entirely.

In **Harrison county** the Gordon is a great oil horizon in the western portions of Sardis, Ten Mile, and Union districts. It is also a fair gas sand in Union, Eagle, Coal, and Grant districts.

The table of wells for each county, given on subsequent pages of this report, exhibits its depth and thickness in the area under discussion.

The Fourth Sand.

The next oil and gas horizon below the Gordon is the Fourth sand. It is frequently identified as the Gordon and is generally reported by the drillers in the Doddridge-Harrison area from 2125 to 2225 feet below the Pittsburgh coal.

In **Doddridge county** it has produced some gas in the northern portion of McClellan district. The A. C. Ballouz No. 1 well (14), located 2¼ miles east of Centerpoint, reports this sand at a depth of 2143 feet below the top of the Pittsburgh coal, and 8 feet below the Gordon sand. Here the sand is 10 feet thick, the gas pay occurring 4 feet in the sand.

In **Harrison county** the Robinson run oil pool, located one mile west of Shinnston, occurs in the Fourth sand. There the V. B. Ogden No. 2 well shows this sand at a depth of 2190 feet, 2205 feet below the crop of the Pittsburgh coal and 785 feet below the top of the Big Injun sand. It is also a gas horizon in Sardis, Union, Eagle, Coal, Grant, and Clay districts.

The Fifth Sand.

The next oil and gas horizon below the Fourth sand is what is known to the drillers as the Fifth or McDonald sand. It received the latter name from the McDonald oil field of Washington, county, Penna. It is a great gas horizon in Greene county of the latter State. In the Doddridge-Harrison area this sand comes 2250 to 2400 feet below the Pittsburgh coal.

In **Doddridge county** this sand has produced some gas in McClellan and Grant districts. The only place where it has produced oil is in the extreme eastern point of Greenbrier district, northeast from Big Isaac.

In **Harrison county** this sand is a great oil and gas horizon. The Wolf Summit oil field, extending along the eastern border of Ten Mile district, and the western border of Union, gets the major portion of its production from the Fifth sand. Eastward along the crest of the Wolf Summit anticline it is a fine gas horizon. Likewise in Clay, Coal, Clark, Simpson, Grant, and Elk districts.

The Bayard, or Sixth Sand.

The next sand below the Fifth is what is known to the drillers as the Bayard, or Sixth sand. It received the first appellation from a well on the Thomas Bayard farm, located 4 miles southeast from Waynesburg, Greene county, Penna., where it is reported 10 feet thick, coming 2417 feet below the Pittsburg coal, and 70 feet below the Fifth sand. In the area under discussion it comes 2425 to 2475 feet below the Pittsburgh coal, and about 100 feet below the Fifth sand.

In **Doddridge county** a show of oil was encountered in the Tate Bros. No. 1 well (120), located 1.5 miles northwest from Long Run, in a sand 10 feet thick, coming 2321 feet, below the top of the Pittsburgh coal, that appears to correlate with the Bayard. The interval seems a little short, however, so that it may represent the Fifth sand.

In **Harrison county**, a show of gas was encountered in Jas. Coffman No. 1 well (564), located in Eagle district, 2 miles north 85° west of Peora, in a sand 7 feet thick, coming 2388 feet below the top of the Pittsburgh coal, that appears to correlate with the Bayard. Although the well was drilled over 300 feet deeper, no more sand was struck. A show of gas is also reported in the Bayard sand in the Alice Corpening No. 1 well (612), located in Clay district, 1.7 miles south 75° east of Enterprise. A show of oil was struck in the Silas Ogden No. 1 well (648), located 0.9 mile south 80° east of Gypsy, in the Bayard sand, 44 feet thick, coming 2429 feet below the top of the Pittsburgh coal.

Southward on Jack run, three-fourths mile northeast from Glen Falls, we find a small oil pool in the Bayard sand as represented by the R. W. Coon (665) and N. M. Talbott (666) wells. Here it comes 2475 feet below the Pittsburgh coal, 970 feet below the top of the Big Injun sand, and 60 feet below the base of the Fifth sand.

In Simpson district a show of oil and gas was encountered in the Bayard sand in the wells Nos. 688 and 689 near Bridgeport.

In Grant district a little gas and an oil show was struck in the Enoch Gaston No. 1 well (722), located 2.7 miles west of Lost Creek station, in the Bayard sand, 10 feet thick, coming 2430 feet below the top of the Pittsburgh coal, and 30 feet below the Fifth sand.

The Speechley Sand.

The Speechley sand has been placed by F. H. Oliphant[2a] at 3100 feet below the Pittsburgh coal. Whether or not this horizon will ever produce oil and gas in paying quantities in West Virginia, has not yet been demonstrated. On page 358 of the Marshall-Wetzel-Tyler report, the writer mentions the possibilities of the existence of an oil pool at this horizon in western Marshall county.

During 1910 the American Hydroscope Company of New York drilled a well on the T. E. Dye farm at Pike, 2.5 miles northwest of Ellenboro, to a depth of 4450 feet, approximately

---

[2a] Vol. I (a), page 85, W. Va. Geol. Survey; 1904.

4030 feet below the horizon of the Pittsburgh coal. A flow of oil is reported in the bottom of the Speechley sand at a depth of 3125 feet, or approximately 2700 feet below the Pittsburgh coal horizon.

In the Doddridge-Harrison area at least three wells (688A, 732C and 737) have penetrated the Speechley sand horizon. The detailed record of one of these wells (698A) is published in connection with the Grassland section, page 120. In it a little gas is reported at a depth of 3125 feet below the Pittsburgh coal, which comes probably at the horizon of the Speechley sand, since the interval agrees closely with that given by Oliphant above. The westward thinning of the Mauch Chunk and Pottsville measures accounts in large degree for the decreased interval in the Dye well in Ritchie county.

OIL AND GAS DEVELOPMENT IN THE DODDRIDGE-HARRISON AREA.

Early History.

Doddridge County.—According to I. C. White[3] the history of the oil and gas development of Doddridge county began with the opening up of the **Centerpoint oil pool** early in 1892 by the South Penn Oil Company in its Sullivan Heirs No. 1 well (71), located on the north bank of McElroy creek, three-fourths mile northwest from Centerpoint. The oil pay was encountered in the Big Injun sand. About this time the Company drilled the Chas. Slusser No. 1 well (305), located 0.8 mile westward from Big Isaac. The gas pay was struck in the Big Injun sand.

The next large oil pool to be opened in this county was the **Hardman pool,** located in the extreme northwest portion of McClellan district along the Doddridge-Tyler county line. According to I. C. White[4], Murphy and Jennings drilled the first well in this pool on the Hardman farm in 1895, getting a 500 barrel well in the Big Injun sand. Later, other wells in this field were drilled on down to the Gordon sand and another oil pool obtained at that horizon.

---

[3] Vol. I, page 327-328, W. Va. Geol. Survey; 1899.

[4] Vol. I, page 334, W. Va. Geol. Survey; 1899.

In 1898 the **Sedalia gas pool** was opened in the Gordon Stray sand by the Carter Oil Company in their Camden Heirs No. 1 well (28), located on Robinson fork, 2.8 miles south 10° west from Sedalia. The same company opened the **Stout oil pool** in the Gordon sand, February 1, 1899, according to Dr. White in the same report referred to above, in its S. W. Stout No. 1 well (227), located on South fork of Hughes river, 0.6 mile southeast from Kelly. This well had a daily production of 50 barrels one month after being drilled in.

Later important fields to be opened in this county were the **Robinson Fork oil pool** in the Gordon sand in the eastern part of McClellan district; the **Harris oil pool** in the Big Injun sand located in the western part of Central district; the **Smith oil pool** in the Big Injun sand, located 1.5 miles north of West Union; the **St. Clara oil pool** in the Berea sand, located in the extreme southern point of Cove district; the **Long Run oil pool** along the eastern border of Grant and Greenbrier districts; and the great gas pool along the crest of the Arches Fork anticline. All of these will be discussed more in detail on subsequent pages of this report.

Harrison County.—Drilling operations, mainly for oil, began in Harrison county in the early 80's of the last century. Dry holes were drilled in Clarksburg and near Quiet Dell. The first oil was struck in the I. L. Marsh No. 1 well (373), located in the northwest edge of Brown and drilled by I. C. White and T. M. Jackson in 1890, the log of which is used in connection with the section for Brown, page 90. In this well a flow of black oil was encountered in the Big Dunkard sand at a depth of 522 feet below the Pittsburgh coal. The well was never pumped, but a considerable amount of oil was carried away by farmers for domestic purposes.

Later fields to be opened were the **Jarvisville oil pool** in the Fifth sand in the western edge of Union district; the extension of the **Folsom oil pool** of Wetzel county in the Gordon sand southeastward into the northwest portion of Sardis district; the **Salem oil pool** in the same sand along the western border of Ten Mile district; the great gas pools along the crests of the Wolf Summit, and Chestnut Ridge anticlines; and the **Shinnston oil pool** in the Fifty-foot sand in the northern portion of Clay district. The latter pool was opened by the Hope Natural Gas Company in December, 1908, by its R. R. Hardesty No. 1 well (614), located on the Left fork of Mudlick run, 2 miles due east of Shinnston. These and other minor fields will be discussed more fully on subsequent pages of this report.

DODDRIDGE COUNTY WELL RECORDS.

The main source of information as to the thickness and character of the several formations of economic interest where they lie deeply buried below drainage in the Doddridge-Harrison area has been the logs or records of the many wells bored for oil and gas therein by both individuals and corporations. Through the courtesy of the latter the writer has been enabled to collect the records of a large number of wells, on nearly all of which levels were taken in the field while gathering data for this report. A large number of the records are incomplete, in that often only the principal oil and gas horizons are noted. The importance of keeping an accurate and detailed record of the depth, thickness, and character of all **coals, red beds, limestones, dark slates,** and oil and **gas pays,** as well as the depth at which water is found, cannot be overestimated. This feature is well set forth by I. C. White in the Preface to Vol. I(A) of the State Geological Survey reports.

The accompanying table contains the abbreviated records of 240 wells in Doddridge county, as well as the tidal elevations of several other wells, the records of which were not obtainable at this time. The wells are numbered consecutively from 1 up to 317, and grouped largely by magisterial districts, the serial number in each case corresponding to the map number of the same well as located on the economic geology map accompanying this report. A similar table is found on a subsequent page for Harrison county, and in nearly all cases where one of these wells is mentioned in the body of the text, the serial number of the well is added in parenthesis.

Under the column headed "Owner" in the Doddridge county table of well records, the following abbreviations are used:

Acme Carbon	Acme Carbon Company.
Bish & Elder	Bish & Elder Oil Company.
Boliver	Boliver Oil & Gas Company.
Carnegie	Carnegie Natural Gas Company.
Carter	Carter Oil Company.
Castle Brook	Castle Brook Carbon Company.
Centerpoint	Centerpoint Gas Company.
Eastern	Eastern Oil Company.
Elkhorn	Elkhorn Oil & Gas Company.
Empire	Empire Oil Company.
Federal	Federal Oil Company.
Greenlee & For	Greenlee & Forest.
Greenwood	Greenwood Natural Gas Company.
Hagerstown	Hagerstown Oil Company.
Hope	Hope Natural Gas Company.
Jennings	Jennings Oil Company.
McCoy	McCoy Oil Company.
Mt. State Carbon	Mountain State Carbon Company.
Murphy & Jen	Murphy & Jennings.
Murphy O. Co	Murphy Oil Company.
Penna	Pennsylvania Oil & Gas Company.
Phila	Philadelphia Company.
Preston O. & G	Preston Oil & Gas Company.
Salem G. Co	Salem Gas Company.
Southern	Southern Oil Company.
South Penn	South Penn Oil Company.
Welch O. & G	Welch Oil & Gas Company.
West Union	West Union Oil & Gas Company.
Wheeling	Wheeling Natural Gas Company.
Wolf Summit	Wolf Summit Oil & Gas Company.

In the elevation column the letter "B" indicates that the elevation of the top of the hole was obtained by aneroid checked with nearby U. S. G. Survey spirit level elevations; the letter "L," by spirit level measurement. The elevations of the top of the hole are expressed in feet above tide. Depths and thicknesses of the formations are given in feet.

Under the column headed "Producing Sand," the following abbreviations are used:

I C. R.	First Cow Run.
B. Dunk	Big Dunkard.
II C. R.	Second Cow Run.
Max	Maxton.
B. Lm	Big Lime.
Knr	Keener.
Big I.	Big Injun.
Berea	Berea Grit.
Gnz	Gantz.
50-ft	Fifty-foot.
30-ft	Thirty-foot.
Stray	Gordon Stray.
Gord	Gordon.
4th	Fourth.
5th	Fifth, or McDonald.
6th	Sixth, or Bayard.

Summarized Record of

Map No.	NAME OF WELL	Location—District	OWNER	Elevation A. T.
1	Smith & Robinson No. 1	McClellan	Carnegie	965B
2	P. E. Swiger No. 1	McClellan	McCoy	895B
3	Ucal Bates No. 1941	McClellan	Phila	960B
4	Josiah Davisson No. 1	McClellan	Carnegie	880B
5	Daniel Swiger No. 1	McClellan	Rand et al	815B
6	A. J. Ashcraft No. 1	McClellan	Carnegie	1240B
7	A. J. Ashcraft core test	McClellan	Arnett et al	1005B
8	Geo. Ashcraft No. 1	McClellan	Hope	930L
9	Luther E. Kyle No. 1	McClellan	Phila	960B
10	I. H. Ford's Hrs. core test	McClellan	Arnett et al	959B
11	Caleb Ashcraft No. 1	McClellan	Hope	1075B
12	W. J. Booher No. 1	McClellan	Hope	885B
13	D. L. Swiger No. 1	McClellan	Hope	930B
14	A. C. Ballouz No. 1	McClellan	Wheeling	950B
15	F. S. Swiger No. 1	McClellan	Hope	958B
16	Solomon Frum No. 1	McClellan	Wheeling	885B
17	Mary E. Ritter No. 1	McClellan	Hope	965B
18	F. S. Estlack No. 1	McClellan	Hope	.....
19	Elias Underwood core test	McClellan	J. V. Thompson	795B
20	Nancy Smith No. 1	McClellan	Phila	860B
21	J. Hudson core test	McClellan	J. V. Thompson	830L
22	E. S. Boggess No. 1	McClellan	Carter	1035B
23	W. B. Harbut No. 607	McClellan	Hope	935B
24	S. T. Tate No. 1	McClellan	Eastern	840B
25	M. W. (Catherine) Tate No. 1	McClellan	Carnegie	845L
26	M. W. (Catherine) Tate core test	McClellan	J. V. Thompson	845L
27	H. J. Shahan No. 1	McClellan	Carter	945B
28	Camden Heirs No. 1	McClellan	Carter	975B
28A	C. W. Davisson No. 1	McClellan	Phila	890B
29	Dye & Wise No. 1	McClellan	Carnegie	875B
30	Dye & Wise No. 2	McClellan	Carnegie	1045B
31	Samuel Stout No. 1	McClellan	V. I. Allen	930B
32	I. F. Hill No. 1	McClellan	Hope	.....
33	Lee Taylor No. 1	McClellan	Hope	925B
34	Geo. Frum No. 1	McClellan	Carter	1220B
35	Eliza J. Webb No. 1	McClellan	Carter	940B
36	Eliza J. Webb No. 2	McClellan	Carter	1175B
37	C. Stark No. 6	McClellan	South Penn	1200B
38	F. J. Bartlett No. 1	McClellan	South Penn	1215B
39	E. E. Smith No. 1	McClellan	South Penn	940B
40	C. D. Bartlett No. 1	McClellan	South Penn	1160B
41	Isaac Davis No. 1	McClellan	South Penn	1000B
42	Jamison Hutson No. 1	McClellan	Elk Horn	1375B
43	Jamison Hutson No. 1	McClellan	South Penn	965B
44	Jos. Thomas No. 1	McClellan	Carter	885B
45	Geo. Russell No. 1	McClellan	Carter	940B
46	I. N. Riffee No 1	McClellan	Carter	990B
47	I. N. Riffee No. 2	McClellan	Carter	1030B

Wells in Doddridge County.

PITTSBURGH COAL			BIG INJUN SAND		GORDON SAND		Total Depth	PRODUCING SAND	Map No.
Depth (top)	Elevation (top) A. T.	Thickness	Depth (top)	Thickness	Depth (top)	Thickness			
620	345	13	1957	75	2682	74	2794	Gordon	1
......	......	......	......	......	......	......	......	——————............	2
......	......	......	1977	83	2684	12	2851	Gordon	3
......	......	......	1822	130	2602	17	2843	Gordon	4
......	......	......	......	......	......	......	400	——————............	5
962	278	......	2238	94	2970	......	3100	Stray and Gord..........	6
......	......	......	......	......	......	......	......	——————............	7
......	......	......	1857	83	2606	24	2723	Gord., 4th and 5th.......	8
540	420	6	1886	68	2618	36	2689	Gordon	9
......	......	......	......	......	......	......	......	——————............	10
......	......	......		......	......	......	......	Stray and Gord..........	11
......	......	......		......	......	......	......	Stray	12
......	......	......	......	......	......	......	......	Big Injun................	13
526	424	12	1870	100	2650	11	3129	Big I. and 4th...........	14
......	......	......	......	......	......	......	......	——————............	15
510	375	......	1818	108	2600	15	2615	Gordon	16
......	......	......	1950	110	2724	26	2805	Stray and 5th...........	17
......	......	......	......	......	......	......	......	——————............	18
......	......	......	......	......	......	......	......	——————............	19
470	390	......	1831	99	2530	16	2862	Fourth	20
450	380	6.8	......	......	......	......	457.8	——————............	21
......	......	......	1820	100	2600	......	2800	Big Injun................	22
......	......	......	......	......	2680	15	......	——————............	23
......	......	......	1845	140	2590	......	2885	Gordon	24
558	287	10	1860	125	2667	13	2689	Big I., Stray and Gord....	25
......	......	......	......	......	......	......	......	——————............	26
650	295	10	1950	113	2730	20	2760	Big I. and Gord..........	27
715	260	......	2040	102	......	......	......	Big I. and Stray..........	28
497	393	9	1853	108	......	......	2007	Big Injun................	28A
......	......	......	......	......	......	......	......	——————............	29
676	369	7	2000	......	......	......	......	——————............	30
550	380	8	......	......	......	......	2950	——————............	31
......	......	......	......	......	......	......	......	Big Injun................	32
......	......	......	1828	72	2621	12	2703	Gordon	33
964	256	11	2247	91	3063	17	3295	Gordon oil show.........	34
725	215	12	2035	93	2752	40	2823	Stray	35
970	205	10	2310	70	3047	22	3075	Stray	36
980	220	......	2285	115	3067	20	3087	Stray, gas; Gord., oil.....	37
1022	193	......	2340	100	3072	14	3086	Stray	38
725	215	10	2035	100	2802	4	2806	Stray and Gord..........	39
970	190	6	2281	94	3049	19	3108	Gordon	40
......	......	......	2115	......	2873	......	2935	Gordon oil show.........	41
......	......	......	......	......	......	......	......	Gordon	42
775	190	6	2080	120	2858	14	3206	——————	43
637	248	8	1935	120	2716	18	2740	Gordon	44
......	......	......	......	......	......	......	......	Gordon	45
775	215	10	2075	90	2802	15	2853	Big I., Gordon..........	46
840	190	7	2143	105	2855	28	3029	Gordon	47

Summarized Record of

Map No	NAME OF WELL	Location—District	OWNER	Elevation A. T.
48	S T. Bartlett No. 1	McClellan	Carter	1035L
49	C. Stark No. 1	McClellan	South Penn	920B
50	J. B. Dewhurst No. 1	McClellan	South Penn	1330B
51	J. B. Dewhurst No. 18	McClellan	South Penn	1185B
52	W. B. Hawkins No. 3	McClellan	South Penn	1100B
53	Isaac Ice No. 2	McClellan	South Penn	1175B
54	T. B. Edgell No. 3	McClellan	South Penn	......
55	T. B. Edgell No. 1	McClellan	South Penn	1085B
56	Emeline Snodgrass No. 1	McClellan	South Penn	980B
57	Chas. Edgell No. 1	McClellan	South Penn	940L
58	Sydney Joseph No. 1	McClellan	South Penn	905B
59	Sydney Joseph No. 2	McClellan	South Penn	980B
60	Henry Cumbridge No. (1)	McClellan	South Penn	1290B
61	H. H. Hardman No. 1	McClellan	——————	860L
62	M. J. Yeater No. 1	McClellan	South Penn	845B
63	Jos. Underwood No. 1	McClellan	South Penn	825B
64	Eli Haught No. 1	McClellan	J. Smith & Co	835B
65	Lowndes & Hart No. 11	McClellan	South Penn	975B
66	Silas Langfitt No. 1	McClellan	South Penn	815B
67	Geo. Cumberledge No. 1	McClellan	South Penn	795B
68	Geo. Cumberledge No. 2	McClellan	Centerpoint	780B
69	M. A. Phillips No. 1	McClellan	South Penn	775B
70	Samuel Collins No. 3	McClellan	South Penn	770B
71	Sullivan Heirs No. 1	McClellan	South Penn	775B
72	Harriet McCormick core test	McClellan	C. D. Martin	765B
73	Mahala Sweeney No. 1	McClellan	South Penn	765B
74	Thos. Ash No. 1	McClellan	South Penn(?)	755B
75	John Ash No. 1	McClellan	South Penn	800L
76	Susan P. Swiger core test	McClellan	Martin & Summers	885B
77	M. N. Allen No. 1	McClellan	Carnegie	.....
78	Martha J. Smith No. 1	McClellan	South Penn	805B
79	Israel J. Allen No. 1	McClellan	Murphy & Jen	748L
80	Silas Langfitt No. 4	McClellan	South Penn	743L
81	Silas Langfitt No. 7	McClellan	South Penn	748B
82	Benton Allen No. 5	McClellan	Murphy & Jen	780B
83	O. W. O. Hardman No. 25	McClellan	Murphy & Jen	(855B)
84	Clinton Wright No. 4	McClellan	South Penn	960B
85	O. W. O. Hardman No. 54	McClellan	Murphy & Jen	1200B
86	Lloyd McIntyre No. 1	McClellan	Jennings	985B
87	W. B. Allen No. 7	McClellan	Murphy & Jen	825B
88	Chas. Stewart No 7	Grant	South Penn	748L
89	J. D. McReynolds No. 1	Grant	South Penn	750B
90	J. D. McReynolds No. 17	Grant	South Penn	795B
91	J. D. McReynolds No. 4	Grant	South Penn	760B
92	John McReynolds No. 1	Grant	South Penn	.....
93	Silas Ash No. 2	Grant	South Penn	805L
94	Joseph Costilow No. 1	Grant	South Penn	865B
95	Henry Knight No. 1	Grant	South Penn	865B
96	Chas. Doak No. 1	Grant	South Penn	940B

Wells in Doddridge County.—Continued.

PITTSBURGH COAL			BIG INJUN SAND		GORDON SAND		Total Depth	PRODUCING SAND	Map No.
Depth (top)	Elevation (top) A. T.	Thickness	Depth (top)	Thickness	Depth (top)	Thickness			
760	275	10	2085	125	2853	10	2868	Gordon	48
700	220	10	2000	105	2782	19	2802	Gordon	49
......	......	......	2410	87	......	......	2507	Big Injun	50
......	......	......	2238	......	......	......	2336	———	51
......	......	......	......	......	......	......	......	———	52
......	......	......	......	......	......	......	......	Big I., and Gord	53
......	......	......	......	......	......	......	......	Fifth	54
......	......	......	......	......	......	......	......	Big Injun	55
......	......	......	2065	120	......	......	2197	———	56
......	......	......	......	......	......	......	......	———	57
......	......	......	1941	......	......	......	2075	Big Injun	58
......	......	......	2011	125	2753	12	3010	———	59
......	......	......	......	......	......	......	......	Big Injun	60
......	......	......	......	......	......	......	......	———	61
......	......	......	1920	......	......	......	2032	Big Injun	62
......	......	......	1880	......	......	......	1987	Big Injun	63
......	......	......	......	......	......	......	......	———	64
660	315	......	2010	......	......	......	2139	Big Injun	65
......	......	......	......	......	......	......	......	Big Injun	66
440	355	......	1787	113	......	......	2880	Big I., and Stray	67
450	330	1	......	......	......	......	......	Big Injun	68
......	......	......	1837	75	2540	5	2752	———	69
448	322	6	1804	146	......	......	1950	Big Injun	70
......	......	......	1823	87	......	......	1910	Big Injun	71
......	......	......	......	......	......	......	......	———	72
473	292	4	1817	112	......	......	1929	Big Injun	73
......	......	......	......	......	......	......	......	———	74
......	......	......	1945	113	2670	20	2908	Big Injun	75
......	......	......	......	......	......	......	......	———	76
......	......	......	......	......	......	......	......	———	77
......	......	......	1833	......	......	......	1988	Big Injun	78
......	......	......	1819	......	......	......	1935	Big Injun	79
......	......	......	1803	......	......	......	1900	Big Injun	80
......	......	......	1806	......	......	......	1892	Big Injun	81
570	210	......	1858	......	......	......	1966	Big Injun	82
......	......	......	2030	......	......	......	2182	Big Injun	83
......	......	......	2260	125	3013	6	3037	Big Injun	84
1014	186	......	2304	206	3070	11	3090	Gordon	85
742	243	......	2032	203	2830	5	2842	Gordon	86
......	......	......	1815	......	......	......	1968	Big Injun	87
......	......	......	1796	......	......	......	1875	Big Injun	88
......	......	......	1793	117	......	......	2520	Big I., and Stray	89
......	......	......	1890	......	......	......	1985	Big Injun	90
......	......	......	1806	99	......	......	2581	Big I., and Stray	91
......	......	......	......	......	......	......	......	———	92
495	310	......	1850	......	......	......	1957	Big Injun	93
......	......	......	1915	......	......	......	2035	Big Injun	94
556	309	......	1902	111	......	......	2013	Big Injun	85
628	312	......	1968	112	......	......	2080	Big Injun	96

Summarized Record of

Map No.	NAME OF WELL	Location—District	OWNER	Elevation A. T.
97	Jacob Underwood No. 11	Grant	South Penn	1280B
98	W. A. Costilow No. 1	Grant	Bish & Elder	1280B
99	Wm. Sandy No. 2	Grant	South Penn	920B
100	Wm Sandy No. 1	Grant	South Penn	1160B
101	N. J. Wilcox No. 1	Grant	Greenlee & For	860B
102	Sam'l B. McMillan No. 1	Grant	South Penn	778L
102A	Emma Hoskinson No. 1	Grant	Phila	.....
103	M. A. McMillan et al. No. 2	Grant	Trainer Bros	860B
104	C. I. McMillan No. 1	Grant	Trainer Bros	845B
105	S. B. McMillan No. 1	Grant	Carter	815B
106	Martin V. Underwood No. 2	Grant	Trainer Bros	1130B
107	Chas. Shrader No. 1	Grant	Carter	1110B
108	Johnson Williams No. 1	Grant	Carter	910B
109	J. L. Smith No. 1	Grant	Murphy O. Co	940L
110	Jas. Morgan No. 1	Grant	Carter?	925B
111	Mary V. Snider No. 1462	Grant	Hope	1305B
112	Felix Davis No. 1	Grant	Hope	760B
112A	L. O. Kester No. 1	Grant	Penna	895B
113	H. T. Powell No. 1467	Grant	Hope	1000B
113A	Powell & Williams No. 1	Grant	Penna	1090B
114	B. D. Helmick No. 1476	Grant	Hope	1010B
115	M. J. Carr No. 1 (No. 141)	Grant	Hope	866L
116	C. G. Davis No. 1	Grant	Wheeling	935B
117	Susan Sadler No. 1	Grant	Trainer Bros	980B
118	R. B. Davisson No. 1	Grant	Hope	870B
119	R. M. Orr No. 1	Grant	Wheeling	1220B
120	Tate Bros. No. 1	Grant	Wheeling	915B
121	Henry Orrowhood No. 1	Grant	Wheeling	860B
122	Silas Cain No. 1	Grant	Carter	865L
123	John Whalen No. 2	Grant	Carter & Carney	1160B
124	John Whalen core test	Grant	——————	885B
125	Jas. Powell No. 1	Grant	Phila	880B
126	J. D. Crabtree No. 1	Grant	South Penn	835B
127	O. A. Sheets No. 1	Grant	Hope	870B
128	W. A. Stutler No. 1	Grant	Castle Brook	849L
129	Lewis Maxwell No. 2	Grant	Castle Brook	815B
129A	Gordon Rush No. 1	Grant	Acme	.....
130	Z. Offutt No. 1	Grant	Diamond Co	825B
131	Patrick Shaughnessy No. 1	Grant	South Penn	910B
132	Edward Con'ey No. 1	Grant	Federal	955L
133	Robert Starkey No. 2	Grant	South Penn	990B
134	Ellen Kirk No. 1	Grant	South Penn	1365B
135	John Hession No. 1	Grant	South Penn	1330B
136	Mary O'Connor No. 1	Grant	South Penn	......
137	Albert A. Davis No. 1	Grant	South Penn	995B
138	M. Davisson No. 6	Grant	South Penn	1149L
139	Freeman Bros. No. 1	West Union	Phila?	.....
140	W. W. Pratt No. 1	McElroy (Tyler)	South Penn	853L
141	Frank Smith No. 1	West Union	South Penn	.....

Wells in Doddridge County.—Continued.

PITTSBURGH COAL			BIG INJUN SAND		GORDON SAND		Total Depth	PRODUCING SAND	Map No.
Depth (top)	Elevation (top A.T.	Thickness	Depth (top)	Thickness	Depth (top)	Thickness			
950	330	......	2290	119	......	......	2409	Big Injun...............	97
......	......	......	......	......	......	......	......	Maxton	98
......	......	......	1880	......	......	......	2003	Big Injun...............	99
......	......	......	2131	215	2876	20	3005	————	100
......	......	......	......	......	......	......	......	————	101
......	......	......	1735	156	......	......	2005	Big Injun...............	102
......	......	......	2072	183	......	......	2916	Big I., and 5th..........	102A
......	......	......	1820	130	......	......	2000	Big Injun...............	103
......	......	......	1793	90	......	......	1897	Big Injun...............	104
......	......	......	1760	100	......	......	1850	Big Injun...............	105
690	440	......	2067	123	2813	9	2840	B. I., Stray & Gord.....	106
......	......	......	2020	75	2719	8	2478	Max., B. I. & Gord......	107
......	......	......	......	......	......	......	......	————	108
......	......	......	......	......	......	......	......	————	109
......	......	......	......	......	......	......	......	————	110
886	419	6	2220	111	2940	20	3400	Big Injun...............	111
......	......	......	......	......	......	......	......	Big Injun...............	112
462	433	5	1802	106	......	......	1910	Big Injun...............	112A
529	471	3	1902	85	......	......	2055	Max. and Big Injun.....	113
......	......	......	......	......	......	......	2054	Big Injun...............	113A
538	472	16	1880	138	......	......	2035	Max. and Big Injun.....	114
380	486	......	1730	130	......	......	2735	Big Injun...............	115
565	370	7	1900	140	2648	7	2692	II. C. R. and Gord.......	116
660	320	7	1990	135	2740	20	2794	B. I. and Gord..........	117
......	......	......	......	......	......	......	......	————	118
715	505	7	2070	......	......	......	2150	Max. and Big I.........	119
372	543	8	1733	105	......	......	3125	Salt, B. I. & 6th........	120
323	537	6	1693	110	......	......	1890	Salt and B. I.	121
......	......	......	1695	103	......	......	2479	Big Injun...............	122
755	405	9	2150	65	......	......	2242	Big Injun...............	123
465	420	7	......	......	......	......	479	————	124
417	463	......	......	......	......	......	......	Big Injun...............	125
330	505	......	1717	79	......	......	2701	————	126
......	......	......	......	......	......	......	......	Big Injun...............	127
270	579	......	1659	......	......	......	1768	Big I. and Salt..........	128
......	......	......	1546	74	......	......	2193	Big Injun...............	129
240	......	6	1624	......	......	......	1640	Big I..................	129A
......	......	......	......	......	......	......	......	————	130
645	265	5	2010	85	2721	4	2725	————	131
......	......	......	......	......	......	......	......	————	132
......	......	......	......	......	......	......	......	————	133
1120	245	6	2475	80	3200	13	3228	Gordon	134
1070	260	5	2455	120	3161	12	3220	Gordon	135
1040	......	6	2388	110	3130	12	3185	Gordon	136
742	253	8	2075	110	2849	15	2881	Stray and Gordon.......	137
924	225	......	2252	80	3015	12	3028	————	138
......	......	......	......	......	......	......	......	————	139
......	......	......	......	......	......	......	......	Big Injun...............	140
......	......	......	......	......	......	......	......	————	141

Summarized Record of

Map No.	NAME OF WELL	Location—District	OWNER	Elevation A. T.
142	Wm. Smith No. 1	West Union	South Penn	865B
143	Ed. Cain No. 1	West Union	Carter	785B
144	Jos. Freeman No. 1	West Union	South Penn	759L
145	E. O. Ford No. 1	West Union	Boliver	770B
146	Wm. Freeman No. 1	West Union	Murphy & Jen	835B
147	Frank Smith No. 1	West Union	West Union	1185B
148	Frank Smith No. 2	West Union	Wolf Summit	980B
149	Frank Smith No. 1	West Union	Wolf Summit	1100B
150	Smith & Carr No. 1	West Union	Wolf Summit	1045B
151	Nancy Scott No. 1	West Union	Wm. Maxwell	790B
152	Frank Maxwell Heirs No. 1	West Union	Wm. Maxwell	.....
153	Vincent Cain No. 1	West Union	Trainer Bros	945B
154	D. L. Dotson No. 1	West Union	Eastern	865B
155	P. B. McClain No. 1	West Union	Eastern	1010B
156	John Coulahan No 1	West Union	Eastern	940B
157	Robt Harper No. 1	West Union	Phila	950B
158	S. O. Jones No 1	West Union	Trainer Bros	800L
159	Steel Heirs No 1	West Union	Carter (Wheeling)	865B
160	Thos. Ryan No. 1	West Union	Acme	800B
161	Lloyd Davis No. 1	West Union	Carter	860B
162	L. T. Davis No. 1	West Union	Empire	780B
163	Gribble & Dufore No. 1	West Union	Gribble & Dufore	786L
164	Jap Stewart Heirs No. 1	West Union	Empire	845B
165	Jos. Cheuvront No. 1	West Union	Empire	930B
166	Lewis Maxwell No. 8	West Union	Mt. State Carbon	900B
167	Lewis Maxwell No. 1	West Union	Phila	832L
168	B. Foley et al. No. 1	West Union	Phila	845B
169	Jacob Netzer No. 1	West Union	Carter	830B
170	Fielding Britton No. 1	West Union	Hope	840B
171	Lewis Maxwell No. 1	West Union	Mt. State Carbon	870B
172	Lewis Maxwell No. 1	West Union	Acme	905B
173	Lewis Maxwell No. 2	West Union	Acme	905B
174	Leeman Maxwell No. 4	West Union	Carnegie	1005B
175	Leeman Maxwell No. 6	West Union	Carnegie	880B
176	Lafayette & Fleming No. 1	West Union	Carter	860L
177	Jos. Freeman No. 1	West Union	Carter	890B
178	J. Wesley Smith No. 1	West Union	Carter	925L
179	Harvey Smith No. 1	West Union	Carter	900B
180	Harvey Smith No. 2	West Union	Carter	955B
181	Ed Smith No. 1934	West Union	Phila	940B
182	W. C. Griffith No. 1	Central	Greenwood	740B
182A	Finley Dotson No. 1	Central	Carter	770B
183	W. Harrison Piggott No. 1	Central	Hope	765B
184	Chas. Piggott core test	Central	Barnes et al	775B
185	Perry Hutson No. 1	Central	South Penn	805B
186	John Chisler No. 1	Central	Carter	900B
187	F. J. Ruley No. 1	Central	South Penn	840B
188	W. A. Duckworth No. 1	Central	Carter	865B
189	Frank Cooper No. 1	Central	Carter	980B

Wells in Doddridge County.—Continued.

PITTSBURGH COAL			BIG INJUN SAND		GORDON SAND		Total Depth	PRODUCING SAND	Map No.
Depth (top)	Elevation (top) A. T.	Thickness	Depth (top)	Thickness	Depth (top)	Thickness			
......	......	......	......	......	......	......	......	———	142
......	......	......	1695	103	......	......	2479	Big Injun...............	143
......	......	......	1707	89	......	......	2750	Big Injun...............	144
......	......	......	......	......	......	......	......	Big Injun...............	145
514	321	6	1863	107	......	......	2788	Big Injun...............	146
841	344	......	2228	101	......	......	2329½	Big Injun...............	147
644	336	......	2012	......	......	......	2130	Big Injun...............	148
768	332	......	2130	114	......	......	2259	Big Injun...............	149
700	345	......	2067	......	......	......	2167	Big Injun...............	150
......	......	......	......	......	......	......	......	———	151
......	......	......	......	......	......	......	......	Big Injun...............	152
564	381	4	......	......	......	......	2712	Big I. and Gord.........	153
......	......	......	1800	......	......	......	1898	Big Injun...............	154
465	545	......	1875	130	2608	......	2630	Big I. and Stray........	155
......	......	......	1743	......	......	......	1750	Salt and Big I..........	156
......	......	......	1778	127	......	......	2745	Salt, B. Lm. & B. I.....	157
......	......	......	......	......	......	......	......	———	158
......	......	......	......	......	......	......	......	———	159
......	......	......	......	......	......	......	......	———	160
......	......	1	1602	86	2301	4	2514	Salt., B. I., Stray & Gord.	161
......	......	......	1644	144	2330	12	2348	Salt, and Gord..........	162
......	......	......	1645	85	2338	8	2362	Gordon	163
......	......	......	......	......	2403	5	......	Gordon	164
......	......	......	......	......	2408	7	......	B. I., and Gord..........	165
......	......	......	1696	91	2383	14	2433	Big I..................	166
445	387	......	1850	60	......	......	3053	Big I. and Berea........	167
......	......	......	......	......	......	......	......	———	168
310	520	3	1702	70	......	......	2493	———	169
......	......	......	......	......	......	......	......	———	170
210	695	3	1640	30	2300	10	2405	B. I., and Gord.........	171
......	......	......	......	......	......	......	......	Big Injun...............	172
......	......	......	......	......	......	......	1405	B. Dunk. and Salt.......	173
......	......	......	1730	70	......	......	......	Salt	174
......	......	......	......	......	......	......	1340	Salt	175
......	......	......	1700	66	2319	8	2445	I C. R., B. Lm., & Big I..	176
......	......	......	......	......	......	......	......	Big I..................	177
......	......	......	1753	75	......	......	1857	B. Lm. and Big I........	178
410	490	3	1745	......	......	......	1745	Big I..................	179
470	485	2	......	......	......	......	......	Big I..................	180
550	390	5	1930	70	2515	2	2843	Big I. and B. Lm........	181
......	......	......	......	......	......	......	......	———	182
......	......	......	1698	117	......	......	1884	Salt and Big I..........	182A
......	......	......	......	......	......	......	......	Big I..................	183
......	......	......	......	......	......	......	412	———	184
......	......	......	......	......	......	......	......	Big I..................	185
......	......	......	1916	59	2625	......	3085	———	186
......	......	......	......	......	......	......	......	———	187
......	......	......	1916	78	......	......	2081	B. Lm. and Big I........	188
......	......	......	1971	55	......	......	2136	Big I..................	189

Summarized Record of

Map No.	NAME OF WELL	Location—District	OWNER	Elevation A. T.
190	John Harris No. 1	Central	Carter	835B
191	Williamson Heirs No. 1	Central	Carter	819L
192	Carter-Harris No. 1	Central	Carter	825B
193	Dan'l H. Harris No. 3	Central	Carter	835B
194	B. C. Powell No. 1	Central	Carter	900B
195	Dan'l H. Harris No. 2	Central	Carter	830B
196	School House Lot No. 1	Central	Greenwood	870B
197	David Ankrom No. 1	Central	———————	.....
198	Wm. Flanagan No. 1	Central	Murphy & Jen	815B
199	Eugene Henry coal test	Central	H. G. Davis	875B
200	Eugene Henry coal test	Central	Eugene Henry	910B
201	Rachael Bee No. 1	Central	Carter	945B
202	L. D. Stuck No. 1	Central	Carter	895L
203	County Farm No. 1	Central	———————	870B
204	S. H. Douglas No. 1	Central	Carter	900B
205	Jack Cunningham No. 1933	Central	Phila	1060B
206	Nancy Smith No. 1	Central	Carter	935L
207	F. A. Leach No. 1	Central	Murphy & Jen	825B
208	S. A. Hansford No. 1	West Union	Carter	985B
209	D. M. Haught No. 1	Southwest	Phila	940B
210	W. L. Stinespring No. 1	Southwest	Carter	895B
211	C. P. Broadwater No. 1	Southwest	Carter	810L
212	Granville S. Nutter No. 1932	Southwest	Phila	830B
213	David W. Gray No. 2	Southwest	Carter	840B
214	David W. Gray No. 1	Southwest	Carter	860B
215	Eli Nutter No. 1	Southwest	Carter	930B
216	W. Brent Maxwell No.	Southwest	Carter	895B
217	M. H. Wilson No. 1	Southwest	Carter	935B
218	Eli M. Gaston No. 1	Southwest	Carter	900B
219	S. M. Gaston No. 1	Southwest	Carter	920B
220	W. B. Maxwell No. 8	Southwest	Carter	910B
221	W. B. Maxwell No. 2	Southwest	Carter	920B
222	W. B. Maxwell No. 4	Southwest	Carter	940B
223	W. M. Stout No. 10	Southwest	Carter	980B
224	S. W. Stout No. 7	Southwest	Carter	905B
225	S. W. Stout No. 2	Southwest	Carter	930B
226	S. W. Stout No. 4	Southwest	Carter	935B
227	S. W. Stout No. 1	Southwest	Carter	935B
228	S. W. Stout No. 19	Southwest	Carter	990B
229	S. W. Stout No. 18	Southwest	Carter	990B
230	C. D. Allender No. 1	Union (Ritchie)	Carter	970B
231	Wm. Adams No. 1	Union (Ritchie)	Carter	790B
232	Hamilton Russell No. 1	Cove	South Penn	1080B
233	L. G. Chapman No. 1	Cove	Southern	.....
234	Jas. H. Bode No. 1	Cove	South Penn	1075B
235	Jas. H. Bode No. 8	Cove	South Penn	1075B
236	John A. Bode No. 2	Cove	South Penn	1125B
237	John A. Bode No. 1	Cove	South Penn	990B
238	Wm. H. Bode No. 1	Cove	South Penn	930B

Wells in Doddridge County.—Continued.

PITTSBURGH COAL			BIG INJUN SAND		GORDON SAND		Total Depth	PRODUCING SAND	Map No.
Depth (top)	Elevation (top) A. T.	Thickness	Depth (top)	Thickness	Depth (top)	Thickness			
......	......	......	1778	93	......	......	1910	Big I..................	190
......	......	......	1764	100	......	......	1879	Big I..................	191
......	......	......	1775	25	......	......	1814	Big I..................	192
......	......	......	1785	105	......	......	1895	Big I..................	193
......	......	......	1866	55	......	......	1921	Big I..................	194
......	......	......	1795	98	......	......	2130	————————	195
......	......	......	......	......	......	......	......	Big I..................	196
......	......	......	......	......	......	......	......	————————	197
......	......	0	1740	84	2486	12	2712	Max., Big I., and Gantz..	198
......	......	......	......	......	......	......	......	————————	199
......	......	......	......	......	......	......	......	————————	200
690	255	1	2028	89	......	......	2147	————————	201
......	......	0	2000	50	......	......	2828	————————	202
......	......	......	......	......	......	......	......	————————	203
......	......	......	......	......	......	......	1794	Maxton	204
652	408	3	1985	63	......	......	......	B. Lm. and Big I........	205
......	......	......	......	......	......	......	......	————————	206
......	......	......	......	......	......	......	......	————————	207
574	411	1	1943	87	......	......	2081	————————	208
......	......	0	1825	75	......	......	2878	Keener	209
525	370	3	1886	60	......	0	2655	————————	210
......	......	......	......	......	......	......	2106	Big Dunkard...........	211
......	......	0	1745	90	2425	75	2738	Big I..................	212
470	370	4	1815	40	......	......	2121	Big I..................	213
480	380	1	1718	......	......	......	1755	————————	214
......	......	......	1678	30	2315	......	2404	Big I..................	215
......	......	......	1670	80	2330	4	2551	Big I. and Gord.........	216
......	......	......	1833	33	......	......	2116	B. Lm..................	217
......	......	......	1660	40	2295	2	2500	Big I..................	218
......	......	......	1700	50	2310	6	2385	Big I. and Stray........	219
......	......	......	1650	80	2273	6	2300	B. Dunk., Max. & Gord..	220
......	......	......	1605	60	2280	6	2304	Big I. and Gord.........	221
......	......	......	1640	80	2288	4	2312	Big I. and Gord.........	222
......	......	......	1736	160	2397	5	2422	Gordon	223
......	......	......	1830	100	2499	5	2519	Gordon	224
......	......	......	1705	95	2443	5	2484	Gordon	225
......	......	......	1760	70	2421	4	2472	Gordon	226
......	......	......	1705	155	2443	5	2484	Gordon	227
......	......	......	1850	100	2506	8	2530	Gordon	228
......	......	......	1970	55	2572	5	2597	Gordon	229
......	......	......	2150	32	......	......	2184	Big I..................	230
......	......	......	1674	47	......	......	2670	Salt and Big I..........	231
......	......	......	......	......	......	......	......	————————	232
......	......	......	1800	100	2440	......	2730	Big I..................	233
......	......	......	2007	104	2653	5	2680	Gordon	234
......	......	......	2040	110	2675	5	2680	Gordon	235
......	......	......	2110	105	2754	7	2782	Gordon	236
......	......	......	1964	90	2597	5	2612	Gordon	237
......	......	......	1935	......	2569	5	2595	Gordon	238

Summarized Record of

Map No.	NAME OF WELL	Location—District	OWNER	Elevation A. T.
239	Andrew (J.) Hurst No. 1	Cove	South Penn	930B
240	W. M. Williams No. 1	Cove	Carter	900L
241	John Wanstreet No. 1	Cove	Carter	855B
242	Jacob Ruppert No. 1	Cove	Southern	940B
243	John H. Schmidt No. 1	Cove	———	1095B
244	Henry U. Wanstreet No. 1	Cove	Carter	990B
245	P. Brannon No. 1	Cove	Hagerstown	813L
246	Henry Bode No. 1	Cove	South Penn	860B
247	Jos. Krenn No. (3?)	Cove	South Penn	830B
248	Christian Albers No. 1	Cove	South Penn	803L
249	John Gemps No. 1	Cove	South Penn	810B
250	Chas. Fischer No. 1	(Lewis County)	South Penn	810L
251	John Rastle No. 2	(Lewis County)	South Penn	.....
252	John Bland No. 1	New Milton	Castle Brook	855B
253	Geo. McClain No. 2	New Milton	Castle Brook	855B
254	Franklin Randolph No. 1	New Milton	Preston O. & G.	815L
255	A. F. Randolph No. 1	New Milton	South Penn	826L
256	A. M. Greathouse No. 1	New Milton	South Penn	915B
257	Lewis Maxwell No. 1	New Milton	Trainer Bros.	.....
258	Porter Maxwell No. 34	New Milton	Murphy O. Co.	965B
259	Porter Maxwell No. 31	New Milton	Murphy O. Co.	925B
260	Mary E. Gabbert No. 1	New Milton	South Penn	1070B
261	Wm. Stout No. 8	New Milton	Carter	1265B
262	J. B. Maxwell No. 2	New Milton	South Penn	1055B
263	J. B. Maxwell No. 1	New Milton	South Penn	975B
264	C. C. Pearcy No. 1	New Milton	South Penn	1095B
265	L. W. Pearcy Heirs No. 1	New Milton	South Penn	985B
266	John Gribble No. 3	New Milton	Carter	1135B
267	John Gribble No. 2	New Milton	Carter	1100B
268	Fred Fisher No. 3	New Milton	Carter	1165B
269	John Gribble No. 1	New Milton	Carter	925B
270	B. M. Crook core test	New Milton	J. V. Thompson	925L
271	Jas. Maxwell No. 1	New Milton	Carter	881L
272	Mary V. Dillon No. 1	New Milton	Welch O. & G.	840L
273	John W. Rymer No. 1	New Milton	South Penn	850B
274	J. M. Cox No. 1	New Milton	Hope	955B
275	Jacob J. Cox No. 1	New Milton	Carter	891L
276	J. C. Cumpston No. 1	New Milton	Hope	....
277	D. H. Nicholson No. 1	New Milton	South Penn	1015B
278	W. B. Maxwell No. 1	New Milton	South Penn	1285B
279	D. A. Kelley No. 1	Greenbrier	Hope	1040B
280	Hick Davis No. 1	Greenbrier	R. K. Jones	920B
281	Minerva Sadler No. 1	Greenbrier	South Penn	910B
282	F. M. Williams No. 1	Greenbrier	South Penn	945B
283	L. Gainer No. 1	Greenbrier	South Penn	1000B
284	M. T. Williams No. 1	Greenbrier	South Penn	1000B
285	Edith Stout No. 1	Greenbrier	J. Randolph	885B
286	M. T. Williams No. 5	Greenbrier	South Penn	940B
287	M. T. Williams No. 2	Greenbrier	South Penn	915L

Wells in Doddridge County.—Continued.

PITTSBURGH COAL			BIG INJUN SAND		GORDON SAND		Total Depth	PRODUCING SAND	Map No.
Depth (top)	Elevation (top) A. T.	Thickness	Depth (top)	Thickness	Depth (top)	Thickness			
......	......	......	......	......	......	......	......	Big I.	239
......	......	......	1940	92	2564	6	2587	Gordon	240
......	......	......	1952	95	2539	8	2564	Gordon	241
......	......	......	2080	82	......	......	3008	————	242
......	......	......	2110	185	2840	1	3102	Big I. and Berea	243
......	......	......	......	......	......	......	......	————	244
......	......	......	......	......	......	......	......	————	245
......	......	......	......	......	......	......	......	————	246
......	......	......	......	......	......	......	......	————	247
324	479	......	1738	152	......	......	2207	Berea	248
......	......	......	1730	......	......	......	2200	Berea	249
315	495	......	1710	205	......	......	2186	Berea	250
......	......	......	2087	103	......	......	2454	Berea	251
......	......	......	......	......	......	......	1061	Salt	252
......	......	......	1579	......	......	......	1626½	Big I.	253
......	......	......	......	......	......	......	2557	————	254
......	......	......	1860	80	2630	......	2864	Big I.	255
......	......	......	1980	90	......	......	2984	————	256
175	......	3	1595	......	......	......	2344	Big I. and Gord.	257
......	......	......		......	2393	4	2415	Gordon	258
......	......	......	......	......	2367	3	2390	Gordon	259
......	......	......	1794	26	2452	8	2480	Big I. and Gord.	260
......	......	......	2040	90	2673	5	2698	Gordon	261
......	......	......	1880	74	2531	3	2562	Gordon	262
......	......	......	......	......	......	......	......	————	263
......	......	......	1948	......	......	......	2001	Big I.	264
......	......	......	1890	90	2568	8	2593	Gordon	265
......	......	......	2140	110	2796	5	2820	Gordon	266
......	......	......	1977	163	2655	1	2800	50-ft. and Gord.	267
......	......	......	2090	115	2727	4	2963	Gordon	268
......	......	......	2100	110	2745	5	2770	————	269
......	......	......	......	......	......	......	......	————	270
......	......	......	2035	75	2655	4	2862	————	271
......	......	......	1946	100	2640	10	2842	————	272
......	......	......	......	......	......	......	......	————	273
......	......	......	......	......	......	......	......	————	274
521	370	5	1995	100	2660	3	2860	————	275
......	......	......	2295	120	2906	5	3542	Gord. and 5th	276
540	475	5	2075	75	2658	7	2906	....	277
795	490	5	2298	125	......	......	2653	Berea	278
......	......	......	......	......	......	......	......	————	279
......	......	......	......	......	......	......	......	————	280
670	240	......	2067	60	2779	4	3079	Gordon	281
......	......	......	2050	110	2792	7	2805	Gordon	282
......	......	......	......	......	......	......	......	Gordon	283
720	280	5	2080	80	2816	10	2836	Gordon	284
......	......	......	......	......	......	......	......	Gordon	285
660	280	5	2039	109	......	......	2716	Gordon	286
630	285	......	1990	90	2725	11	2748	Gordon	287

Summarized Record of

Map No.	NAME OF WELL	Location—District	OWNER	Elevation A. T.
288	Marcellus Clark No. 2........	Greenbrier	South Penn.........	925L
289	Charlotte Clark No. 3........	Greenbrier	South Penn.........	938L
290	R. G. Davis No. 3............	Greenbrier	South Penn.........	1075L
291	L. D. Davis No. 1............	Greenbrier	Southern	985B
292	Jesse Sadler No. 1...........	Greenbrier	Dr. Louchery........	1170B
293	Jesse Sadler No. 1...........	Greenbrier	South Penn.........	1000B
294	O. G. Davis No. 1............	Greenbrier	South Penn.........	895B
295	Isaac Eddy No. 1............	Greenbrier	South Penn.........	918L
296	Maxwell Heirs No. 1.........	Greenbrier	Murphy et al........	960B
297	Isaac Eddy No. 2............	Greenbrier	South Penn.........	890B
297A	J. J. Adams No. 1............	Greenbrier	Randolph & Ward...	880B
298	Henry Meeks No. 1...........	Greenbrier	J. Randolph.........	925B
299	J. H. Meeks No. 1............	Greenbrier	Southern	950B
300	G. W. Burnside No. 1.........	Greenbrier	—	1300B
301	Joseph Richard No. 1.........	Greenbrier	Salem Gas Co......	980B
302	Lewis Hickman No. 1.........	Greenbrier	Salem G. Co.......	975B
303	L. D. Waugh No. 1...........	Greenbrier	Hope	1165B
304	Williams Heirs No. 1.........	Greenbrier	Hope	1005B
305	Chas. Slusser No. 1..........	Greenbrier	South Penn.........	945B
306	Abe Hinkle No. 1...........	Greenbrier	Hope	......
307	D. E. Cox (Nicholson) No. 1..	Greenbrier	Hope	880B
308	Edgar Davidson No. 1........	Greenbrier	South Penn.........	1005B
309	Freeman Heirs No. 1.........	Greenbrier	Hope	......
310	M. M. Sperry No. 1...........	Greenbrier	Hope	915B
311	J. B. Carder No. 1............	Greenbrier	Hofmeir & Deegan..	1040B
312	H. G. Moffett (No. 6).........	Greenbrier	South Penn.........	1420B
313	J. T. Somerville No. 3........	Greenbrier	South Penn.........	1125B
314	A. D. Lawson No. 6...........	Greenbrier	South Penn.........	1150B
315	Geo. T. Richards No. 3.......	Greenbrier	South Penn.........	1195B
316	Wm. Mowrey No. 2...........	Greenbrier	South Penn.........	1295B
317	Wm. Mowrey No. 1...........	Greenbrier	South Penn.........	1190B

Wells in Doddridge County.—Continued.

PITTSBURGH COAL			BIG INJUN SAND		GORDON SAND		Total Depth	PRODUCING SAND	Map No.
Depth (top)	Elevation (top) A. T.	Thickness	Depth (top)	Thickness	Depth (top)	Thickness			
639	286	......	1990	115	2716	12	2750	Gordon	288
730	208	5	2090	120	2808	14	2836	Gordon	289
800	275	......	2170	85	2864	13	2902	Gordon	290
652	333	......	......	......	2739	18	2758	Gordon	291
......	......	......	......	......	......	......	......	————	292
......	......	......	......	......	......	......	......	————	293
......	......	......	......	......	......	......	......	Gordon	294
......	......	......	......	......	......	......	......	Gordon	295
587	373	......	1920	185	2670	30	2930	B. I. Stray & Gordon....	296
......	......	......	......	......	......	......	......	......	297
555	325	......	......	......	......	......	2690	25 bbl. in Gord. at 2672'..	297A
......	......	......	......	......	......	......	......	————	298
600	350	......	......	......	2726	6	2742	Gordon	299
......	......	......	......	......	......	......	......	————	300
628	352	7	2075	55	2708	20	2929	Stray and Gord.........	301
......	......	......	1985	75	2581	......	2808	Big I. and Gord.........	302
700	465	8	2090	......	......	......	......	Gord. and 4th...........	303
......	......	......	......	......	......	......	......	————	304
......	......	......	......	......	......	......	......	Big I..................	305
......	......	......	......	......	......	......	......	————	306
......	......	......	1937	96	2612	13	3207	Gord. and 4th...........	307
......	......	......	2000	160	2621	14	2989	————	308
......	......	......	......	......	......	......	......	————	309
......	......	......	......	......	......	......	2785	Gordon	310
552	488	4	1980	106	2619	22	2909	Gordon	311
......	......	......	2345	125	3006	18	3093	Gordon	312
474	651	6	1900	65	2580	40	2815	5th	313
478	672	5	1900	......	2585	40	2824	Gordon	314
590	605	5	2035	100	2651	35	2989	Gordon Stray...........	315
......	......	......	2020	69	2605	40	2878	5th	316
700	490	4	2125	150	2798	42	3081	5th	317

The accompanying table is very convenient for ready reference as to the depth and thickness of the Pittsburgh coal, and the Big Injun and Gordon sands, but it is of great importance that the complete record of a number of these wells be given, not only to preserve them from loss, but for the large fund of information they contain as to the presence or absence of **other coal beds,** as well as **other oil and gas horizons.** The accurate location of any tabulated well is readily determined by its serial or map number published in the table and with the heading in parentheses when the complete record is given, and also on the economic geology map accompanying this report in a separate cover.

Oil and gas have been produced in every district of Doddridge county. The well records along with a discussion of the several fields and their relation to geologic structure will now be considered by magisterial districts.

McCLELLAN DISTRICT.

McClellan district occupies the northeastern portion of Doddridge county, and adjoins Tyler, Wetzel, and Harrison counties. A glance at the structure map will show that its area is traversed in a northeast-southwest direction by three structural folds; viz., the Arches Fork anticline, and the Robinson and Burchfield synclines. Hence, the strata are very much warped, giving ideal structural conditions for the segregation of oil and gas into pools of commercial value, making this district the richest in these valuable hydrocarbons of any other in the county. Along the crest of the Arches Fork anticline and a short distance down the slopes there occurs a great gas field, consisting of 75 to 100 wells within the borders of the district. In the southeast part of the district we find a Gordon sand pool of oil in the Robinson Basin, consisting of 75 to 90 wells. This pool conforms to the anticlinal theory of the accumulation of oil and gas, since the Gordon sand contains no water in this portion of the State. The same is true with all other sands below the Big Injun in Doddridge and western Harrison counties.

Passing to the western slope of the Arches Fork anticline in this district, a pool of oil is found in the Big Injun sand that follows closely the 275 and 300-foot structure contours of the Pittsburgh coal bed from the head of Beverlin fork of Talkington fork southwestward to the Doddridge-Tyler county line. Taking up these gas and oil pools in the order mentioned, there will now be given the logs of several wells scattered over and along the crest of th Arches Fork anticline:

Smith and Robinson No. 1 Well Record (1).

Located in McClellan District, at Heldreth. Authority, Carnegie Natural Gas Company. Completed Aug. 1, 1904.

(Elevation, 965′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	620	620
Coal, Pittsburgh	13	633
Unrecorded	1324	1957
Big Injun Sand	75	2032
Unrecorded	568	2600
Sand, Gantz? (Thirty-foot)	25	2625
Unrecorded	33	2658
Sand, Fifty-foot? (Gordon Stray)	20	2678
Unrecorded	4	2682
Gordon sand (gas, 2696′ and 2710′)	74	2756
Unrecorded to bottom	38	2794

10″ casing, 350′; 8¼″ casing, 1130′; 5$\frac{3}{16}$″ casing, 2081′; 3″ tubing, 2794′. "Rock pressure, 615 lbs."

The identification in parentheses are by the writer. The Gordon sand is the gas horizon in this well. An unusual thickness of sand—74 feet—appears at this horizon, and it is possible that both the Gordon Stray and Gordon have coalesced.

Ucal Bates No. 1941 Well Record (3).

Located in McClellan District, 3¼ miles northeast of Centerpoint. Authority, Philadelphia Company. Completed Nov. 15, 1903.

(Elevation, 960′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	63	63
Coal, native, (Washington)	2	65
Unrecorded	485	550
Coal, Pittsburgh. (Redstone)	5	555
Unrecorded	570	1125
Big Dunkard sand, white, hard	30	1155
Unrecorded	95	1250
Gas sand, white, hard	30	1280
Unrecorded	35	1315
Sand, Salt? (water, 1340′)	45	1360
Unrecorded	80	1440
Salt sand, white, hard	20	1460
Unrecorded	230	1690
Maxton sand, white, hard	25	1715
Unrecorded	20	1735
Little lime	15	1750
Unrecorded	75	1825
Pencil cave	8	1833
Big Lime	144	1977
Big Injun sand	83	2060

		Thickness. Feet.	Total. Feet.
Unrecorded		365	2425
Sand, Fifty-foot? (Gantz), shells		25	2450
Unrecorded		100	2550
Thirty-foot sand, lime shells		10	2560
Unrecorded		69	2629
Sand, Stray, white, hard	Gordon Stray	5	2634
Unrecorded		8	2642
Sand, Gordon? white, hard		12	2654
Unrecorded		30	2684
Sand, Fourth? (Gordon), white, hard (gas, 2695′)		11	2695
Unrecorded		130	2825
Fifth sand, white, hard		4	2829
Slate to bottom		22	2851

The drillers have erroneously identified the gas horizon as the Fourth sand. It should correlate with the Gordon, as the latter comes 720 to 800 feet below the top of the Big Injun. The coal at 550 feet apparently represents the Redstone and not the Pittsburgh bed, since the latter, according to the J. Hudson diamond drill boring (See Sedalia section, page 70) comes 520 to 525 feet below the Washington coal. The well is just west of the line where the Pittsburgh coal as a merchantable bed disappears.

Josiah Davisson No. 1 Well Record (4).

Located in McClellan District, 2¼ miles northeast of Centerpoint. Authority, G. M. Allender.

(Elevation, 880′, B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	535	535
Coal, Pittsburgh? (Little Pittsburgh)	1	536
Unrecorded	479	1015
Big Dunkard sand	36	1051
Unrecorded	159	1210
Gas sand (Salt water, 8 bailers per hour, at 1232′)	70	1280
Unrecorded	25	1305
Sand, Salt? (Second Cow Run)	65	1370
Unrecorded	350	1720
Little Lime	13	1733
Unrecorded	27	1760
Big Lime	62	1822
Big Injun sand (water, 1837′)	130	1952
Unrecorded (no sands regular)	603	2555
Gordon Stray sand	20	2575
Unrecorded	27	2602
Gordon sand (gas, 2607′)	17	2619
Unrecorded	10	2629
Fourth sand	5	2634
Unrecorded to bottom	209	2843

10″ casing, 204′; 8¼″ casing, 1037′; 6⅝″ casing, 1778′.

The well starts 40 to 50 feet below the crop of the Washington coal; hence, the one foot of coal at 535 feet in the well correlates with the Little Pittsburgh and not the Pittsburgh as given by the driller. The latter, as in the Bates well (3), is evidently absent as a minable bed.

A. J. Ashcraft No. 1 Well Record (6).

Located in McClellan District, 1.5 miles southwest of Rinehart. Authority, Carnegie Natural Gas Company. Completed Feb. 26, 1905.

(Elevation, 1240′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	962	962
Pittsburgh coal and unrecorded	1276	2238
Big Injun sand	94	2332
Unrecorded	458	2790
Fifty-foot sand	30	2820
Unrecorded	150	2970
Sand, Gordon Stray (and Gordon), gas	70	3040
Unrecorded	45	3085
Sand, Gordon? (Fourth) and unrecorded to bottom	15	3100

10″ casing, 180′; 8¼″ casing, 1435′; 6⅝″ casing, 2340′; 4″ casing, 3100′. Packed 143′ from bottom.

Pressure test in 4″ tubing:

1st ½ minute	275 lbs.	3rd minute	410 lbs.
1st minute	360 lbs.	4th minute	415 lbs.
2nd minute	400 lbs.	Rock pressure	700 lbs.

The 70 feet of sand at 2970 feet, most probably represents both the Stray and Gordon, since the interval—847 feet—from the top of the Big Injun to the top of the sand at 3085 feet is apparently too great for the Gordon.

Geo. Ashcraft No. 1 Well Record (8).

Located in McClellan District, 2.5 miles southwest of Rinehart. Authority, Hope Natural Gas Company.

(Elevation, 930′ L.A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1857	1857
Big Injun sand	83	1940
Unrecorded	666	2606
Gordon sand (gas)	24	2630
Unrecorded (gas in Fourth sand)	36	2666
Fifth sand (gas)	11	2677
Unrecorded to bottom	46	2723

The well starts 505 feet above the Pittsburgh coal horizon. The depth to and thickness of the latter coal as well as other coals, were purposely omitted from a number of the logs furnished the Survey by the Hope Natural Gas Company, the Reserve Gas Company, and the South Penn Oil Company.

Luther E. Kyle No. 1 Well Record (9).

Located in McClellan District, 1¼ miles south of Heldreth. Authority, Philadelphia Company.

(Elevation, 960' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	237	237
Sand (Carroll) (Uniontown) (little gas)	13	250
Unrecorded	290	540
Pittsburgh coal	6	546
Unrecorded	109	655
Sand, Murphy? (Minshall)	28	683
Unrecorded	242	925
Little Dunkard sand	103	1028
Unrecorded	28	1056
Big Dunkard sand	49	1105
Unrecorded	30	1135
Gas sand	45	1180
Unrecorded	112	1292
Sand, Salt? (II Cow Run)	48	1340
Unrecorded	222	1562
Maxton sand	95	1657
Unrecorded	23	1680
Little lime	18	1698
Pencil cave	12	1710
Unrecorded	60	1770
Big Lime	78	1848
Slate	3	1851
Lime	35	1886
Big Injun sand (little gas, 1896')	68	1954
Unrecorded	120	2074
Sand, Berea	138	2212
Unrecorded	228	2440
Fifty-foot sand	10	2450
Unrecorded	75	2525
Thirty-foot sand	35	2560
Unrecorded	28	2588
Gordon Stray sand	30	2618
Unrecorded	7	2625
Gordon sand (gas, 2646' and 2661')	36	2661
Unrecorded to bottom	28	2689

This is a very interesting record, in that a light flow of gas was encountered in the Carroll (Uniontown sandstone) sand, coming 290 feet above the Pittsburgh coal, the only one observed in the two counties. The well had an initial volume of 7 million cubic feet of gas daily from the Gordon sand. The well is located on the flattened crest of the Arches Fork anticline, to which structural feature it no doubt owes its large volume.

Other gas wells in the Gordon Stray, Gordon, and Big Injun sands on Sycamore fork that are tabulated are the Caleb Ashcraft No. 1 (11), W. J. Booher No. 1 (12), and D. L. Swiger No. 1 (13).

The two following records are from gas wells in the Fourth and Gordon sands, located on Pike fork on the eastern slope of the anticline:

A. C. Bollouz No. 1 Well Record (14).

Located in McClellan District, 2¼ miles east of Centerpoint. Authority, Wheeling Natural Gas Company.

(Elevation = 950' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	526	526
Pittsburgh coal	12	538
Unrecorded	423	961
Little Dunkard sand	11	972
Unrecorded	63	1035
Big Dunkard sand	105	1140
Unrecorded	60	1200
Gas sand	50	1250
Unrecorded	30	1280
Sand, Salt (II Cow Run and Salt)	180	1460
Unrecorded	268	1728
Little lime	37	1765
Unrecorded	15	1780
Big Lime	90	1870
Big Injun sand (small gas show, 1965')	100	1970
Unrecorded	598	2568
Boulder sand (Thirty-foot)	14	2582
Unrecorded	5	2587
Stray sand	16	2603
Unrecorded	47	2650
Gordon sand	11	2661
Unrecorded	8	2669
Fourth sand (fair gas pay, 2673')	10	2679
Slate, lime and shale to bottom	450	3129

"Filled up to 2681' and shot Nov. 17, 1905, with 40 quarts. Top of shot, 2669'; bottom, 2679'; Anchor, 2 ft. Small increase of gas."

S. Frum No. 153 Well Record (16).

Located in McClellan District, 1¾ miles north of Sedalia. Authority, Wheeling Natural Gas Company.

(Elevation, 885′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	510	510
Pittsburgh coal and unrecorded	785	1295
Salt sand (water) and unrecorded	463	1758
Big Lime	60	1818
Big Injun sand	108	1926
Unrecorded	494	2420
Fifty-foot sand and unrecorded	75	2495
Thirty-foot sand and unrecorded	69	2564
Gordon Stray sand	36	2600
Gordon sand (gas 2600′-2615′) to bottom, and not drilled through	15	2615

"7,000,000 cu. ft. gasser in Gordon sand."

The three following records are from gas wells located on the eastern flank of the Arches Fork anticline on Robinson fork in the Sedalia region. Here the gas horizons are the Big Injun, Gordon Stray, Gordon, and Fourth sands:

Nancy Smith No. 1 Well Record (20).

Located in McClellan District, 1¼ mile northwest of Sedalia. Authority, Philadelphia Company.

(Elevation, 860′ B-A. T.)	Thickness. Feet.	Total. Feet.
Gravel	10	10
Sand, gray, (Waynesburg)	50	60
Sand, gray	147	207
Slate, gray	14	221
Native coal, (Lower Uniontown)	2	223
Slate, white	12	235
Lime	47	282
Slate, white	5	287
Lime	43	330
Slate, gray	5	335
Lime	42	377
Slate, gray	15	392
Lime, blue	43	435
Lime	20	455
Slate, gray	15	470
Pittsburgh coal	8	478
Lime	20	498
Sand, gray (Lower Pittsburgh)	47	545
Slate, gray	30	575
Red rock	15	590
Sand, gray	10	600
Slate, gray	50	650
Lime	43	693

	Thickness. Feet.	Total. Feet.
Red rock	29	722
Slate, white	93	815
Red rock (Pittsburgh)	20	835
Lime	10	845
Slate, white	55	900
Lime	25	925
Slate, white	40	965
Slate, black	35	1000
Lime	15	1015
Sand, white (Big Dunkard)	65	1080
Slate, pink	10	1090
Sand, gray (Upper Freeport)	25	1115
Shale, black	43	1158
Sand, white	28	1186
Shale, black	64	1250
Sand, white ("Gas")	85	1335
Shale, black	15	1350
Lime, black "Gas sand"?	5	1355
Sand, First Salt? (II Cow Run)	63	1418
Slate, black	20	1438
Sand, Salt	47	1485
Shale, black	35	1520
Sand, Salt	20	1540
Slate, black	10	1550
Sand, gray	35	1585
Slate, black	15	1600
Lime, blue	58	1658
Red rock	42	1700
Slate, white	5	1705
Lime	15	1720
Slate, white	34	1754
Big Lime	77	1831
Big Injun sand, hard	99	1930
Slate, gray	124	2054
Squaw sand	77	2131
Slate, gray	166	2297
Lime, blue	23	2320
Slate, gray	30	2350
Fifty-foot sand, black	45	2395
Slate, gray	95	2490
Sand, Stray	5	2495
Slate, white	15	2510
Sand, white	5	2515
Slate, pink	15	2530
Gordon sand, white and hard	16	2546
Slate and shells	80	2626
Fourth sand (gas, 2627')	17	2643
Slate, black	7	2650
Sand	15	2665
Slate, gray	55	2720
Sand	6	2726
Slate to bottom	136	2862

The well starts 50 feet below the crop of the Washington coal. The log is very complete and includes in the top portion 90 to 100 feet of the Dunkard series.

S. T. Tate No. 1 Well Record (24).

Located in McClellan District, one-third mile west of Sedalia. Authority, Eastern Oil Company. Completed August 27, 1897.

(Elevation, 840′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1845	1845
Big Injun sand (little gas, 1905′; enough to run boiler, 1945′)	140	1985
Unrecorded	605	2590
Gordon sand (gas, 2590′; 2600′) and unrecorded to bottom	295	2885

10″ casing, 225′; 8¼″ casing 1197′; 6⅝″ casing, 2130′.

The well starts 20 feet below the Washington coal, and is reported to be one of the best gas wells in the field. Its production is mostly from the Gordon, the same having an initial rock pressure of 800 to 900 pounds to the square inch.

Catharine Tate No. 1 Well Record (25).

Located in McClellan District, at Sedalia. Authority, Carnegie Natural Gas Company. Completed July 11, 1905.

	Thickness. Feet	Total. Feet.
Unrecorded	558	558
Pittsburgh coal	10	568
Unrecorded	1292	1860
Big Injun sand (gas, 1890′; 320 lbs. rock pressure)	125	1985
Unrecorded	515	2500
Gantz sand and unrecorded	25	2525
Fifty-foot sand	20	2545
Unrecorded	77	2622
Gordon Stray sand (gas, 2625′) and unrecorded	45	2667
Gordon sand (gas, 2670′)	13	2680
Unrecorded to bottom	9	2689

"Steel line measurement to sands."
½ minute pressure, 280 lbs. per sq. inch.
1 minute pressure, 320 lbs. per sq. inch.
2 minute pressure, 340 lbs. per sq. inch.
Rock pressure, 380 lbs. per sq, inch.

The well starts flush with the base of the Washington coal. The pressure tests are probably from the gas struck in the Big Injun, since rock pressure for the Gordon Stray and Gordon in this region should be double that given above.

The following record of one of the largest gas wells ever struck in the State is taken from pages 326-327 of Volume I (Edition exhausted) of the State Survey reports:

Camden Heirs No. 1 Well Record (28).

Located in McClellan District, one-half mile southwest of Cascara. Authority, Carter Oil Company. Completed in November, 1898.

(Elevation, 975' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	715	715
Pittsburgh coal and unrecorded (cave at 805')	349	1064
Little Dunkard sand and unrecorded	536	1600
Salt sand and unrecorded	175	1775
Maxton sand and unrecorded	190	1965
Big Lime	75	2040
Big Injun sand (gas)	102	2142
Unrecorded	627	2769
Sand, Thirty-foot? (very large gasser), Gordon Stray	31	2800

"Mr. Aspinwall adds, 'The rock pressure was about 900 lbs., but the volume was not obtained since it was so great that the mercury was blown out of the gauge.' "

At the time of the publication of Volume I, mentioned above, it was thought that this great gas horizon represented the Thirty-foot, but later developments prove it to be the Gordon Stray sand. The production of this well has been enormous, since for a while it supplied the Carter Oil Company with sufficient fuel to operate nearly all its wells in the State, while at the same time a large portion of its production was blowing off with a deafening noise through a safety valve. A pressure test under these conditions exhibited over 700 pounds to the square inch.

For the logs of the E. Stringer Boggess No. 1 well (22), located one mile west of Sedalia, and the H. J. Shahan No. 1 well (27), located one mile northwest of Cascara, the reader is referred to Vol. I(A) of the State Survey reports, pages 282-283. The first is a gasser in the Big Injun sand, and the latter a gasser in both the Big Injun and Gordon sands. The Shahan well (27) also had a showing of oil in the former sand.

Westward to the crest of the Arches Fork anticline, several good gas wells in the Big Injun sand are found on the waters of Big Battle. The following is a record of one of these wells:

C. W. Davisson No. 1 Well Record (28A).

Located in McClellan District, ¾ mile north of Big Battle. Authority, Philadelphia Company.

(Elevation, 890′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	220	220
Coal, (Uniontown)	6	226
Unrecorded	271	497
Pittsburgh coal	9	506
Unrecorded	40	546
Sand, Hurry-Up (Lower Pittsburgh)	7	553
Unrecorded	342	895
Little Dunkard sand	10	905
Unrecorded	96	1001
Big Dunkard sand	85	1086
Unrecorded	67	1153
Gas sand	57	1210
Unrecorded	98	1308
First Salt sand	20	1328
Unrecorded	70	1398
Second Salt sand	25	1423
Unrecorded	274	1697
Maxton sand	10	1707
Unrecorded	42	1749
Little lime	25	1774
Pencil cave	15	1789
Big Lime	64	1853
Big Injun sand (gas)	108	1961
Unrecorded	12	1973
Squaw sand	32	2005
Unrecorded to bottom	2	2007

10″ casing, 605′; 8¼″ casing, 1021′; 6⅝″ casing, 1830′.
Rock pressure, 600 lbs. per sq. inch.

As mentioned on a preceding page, the sands below the Big Injun contain no water in this portion of the State; hence, as should be expected, a Gordon sand oil pool occurs in the synclinal basin next on the southeast from the great gas pool at this horizon, just described, in McClellan district, since nothing prevents the oil from passing down merely by the force of gravity into the Robinson Basin which traverses the southeast border of the latter area. The three following records, taken from pages 283, 284, and 286 of Vol. I(A) of the State Survey reports, give interesting data as to the thickness and relative position of the several sands in the northern portion of the pool within this district:

George Frum No. 1 Well Record (34).

Located in McClellan District, 1.4 miles northeast of Sedalia. Authority, Carter Oil Company.

(Elevation, 1220' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	964	964
Pittsburgh coal	11	975
Unrecorded	225	1200
Cave	95	1295
Unrecorded	102	1397
Sand, Cow Run (I Cow Run)	75	1472
Unrecorded	369	1841
Salt sand	119	1960
Unrecorded	233	2197
Big Lime	50	2247
Big Injun sand	91	2338
Unrecorded	380	2718
Berea sand	18	2736
Unrecorded	204	2940
Sand, (Thirty-foot)	20	2960
Unrecorded	49	3009
Gordon Stray sand	35	3046
Unrecorded	17	3063
Gordon sand (oil, 3076')	17	3080
Unrecorded to bottom (no **Fifth sand**)	215	3295

No record was obtained as to the initial production of these Gordon sand wells, but they ranged from 5 to 100 barrels daily. The log shows the absence of the Fifth sand in this locality and is evidence of its lenticular character, the latter feature no doubt in a great measure accounting for the presence of the Fifth sand oil pool at so high a structural level in the vicinity of Wolf Summit and Jarvisville, Harrison county. Of course, it follows that if the sand was regular and porous northwestward from the latter region to the eastern portion of McClellan district (Doddridge), the oil, owing to the absence of water at this horizon, would gravitate to the low point of the Robinson syncline, as has happened with the Gordon sand.

Eliza J. Webb No. 2 Well Record (36).

Located in McClellan District, 1¼ miles north 70° east of Sedalia. Authority, Carter Oil Company.

(Elevation, 940′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	970	970
Pittsburgh coal	10	980
Unrecorded	310	1290
Cave	200	1490
Unrecorded	10	1500
Sand, Cow Run? (Big Dunkard)	50	1550
Unrecorded	270	1820
Sand, Salt (II Cow Run)	76	1896
Unrecorded	154	2050
Sand, Maxton? (Salt)	40	2090
Unrecorded	118	2208
Big Lime	90	2298
Unrecorded	12	2310
Big Injun sand	70	2380
Unrecorded	610	2990
Gordon Stray sand (oil, 3025)	40	3030
Unrecorded	17	3047
Gordon sand	12	3069
Unrecorded to bottom	6	3075

This well is an exception, in that the oil pay was encountered in the Gordon Stray sand, while the Gordon is apparently dry. As a rule in this field a gas pay is usually struck at the former horizon as will be observed in the following record:

S. Stark No. 6 Well Record (37).

Located in McClellan District, 1.2 miles north 80° east of Sedalia. Authority, South Penn Oil Company.

(Elevation, 1200′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	980	980
Pittsburgh coal and unrecorded	445	1425
Sand, Little Dunkard (I Cow Run)	35	1460
Unrecorded	75	1535
Big Dunkard sand	55	1590
Unrecorded	225	1815
Sand, "Gas"? (Second Cow Run)	75	1890
Unrecorded	85	1975
Salt sand	35	2010
Unrecorded	50	2060
Maxton sand	40	2100
Unrecorded	70	2170
Little lime	50	2220
Unrecorded	10	2230

	Thickness. Feet.	Total. Feet.
Big Lime	55	2285
Big Injun sand	115	2400
Unrecorded	450	2850
Fifty-foot sand	25	2875
Unrecorded	121	2996
Gordon Stray sand (gas, 2998′, 3014′)	47	3043
Unrecorded	24	3067
Gordon sand (oil, 3072′)	20	3087

The following is a list of wells in this Gordon sand oil pool in McClellan district, the complete logs of which are published on the pages indicated of Vol. I(A) of the State Survey reports. A summarized record of the same wells is given in the table of wells for Doddridge county.

Map No.	Name of Well.	Location	Page of Vol. I(A).
38	F. J. Bartlett No. 1	1.5 miles N. E. of Sedalia	287
39	E. E. Smith No. 1	1.4 miles E. of Sedalia	287
43	Jamison Hutson No. 1	1.6 miles S. E. of Sedalia	288
47	I. N. Riffee No. 2	0.7 mile S. E. of Cascara	284

The three following records are from other wells in this Gordon oil pool in McClellan:

C. Stark No. 1 Well Record (49).

Location in McClellan District, one mile east of Sedalia. Authority, South Penn Oil Company.

(Elevation, 920′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	700	700
Coal, Pittsburgh	10	710
Unrecorded	507	1217
Big Dunkard sand	99	1316
Unrecorded	634	1950
Big Lime	50	2000
Big Injun sand	105	2105
Unrecorded	480	2585
Fifty-foot sand	5	2590
Unrecorded	60	2650
Thirty-foot sand	30	2680
Unrecorded	45	2725
Gordon Stray sand	32	2757
Unrecorded	25	2782
Gordon sand	19	2801
Unrecorded to bottom	1	2802

C. D. Bartlett No. 1 Well Record (40).

Located in McClellan District, 1¾ miles east of Sedalia. Authority, South Penn Oil Company.

(Elevation, 1160′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	970	970
Pittsburgh coal	6	976
Unrecorded	394	1370
Sand, Little Dunkard (1 Cow Run)	80	1450
Unrecorded	270	1720
Gas sand	25	1745
Unrecorded	395	2140
Maxton sand	25	2165
Unrecorded	60	2225
Big Lime	56	2281
Big Injun sand	94	2375
Unrecorded	445	2820
Fifty-foot sand (shells) and unrecorded	100	2920
Thirty-foot sand	35	2955
Unrecorded	46	3001
Gordon Stray sand	30	3031
Unrecorded	18	3049
Gordon sand	19	3068
Unrecorded	40	3108

I. N. Riffee No. 1 Well Record (46).

Located in McClellan District, 0.6 mile east of Cascara. Authority, Carter Oil Company.

(Elevation, 775′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	775	775
Pittsburgh coal, good	10	785
Unrecorded	115	900
Cave	390	1290
Sand, Cow Run? (Big Dunkard)	4	1294
Unrecorded	331	1625
Salt sand, shelly (water, 1670′)	150	1775
Unrecorded	65	1840
Sand, Maxton? hard (Second Salt)	20	1860
Unrecorded	120	1980
Cave	30	2010
Big Lime, sandy	65	2075
Big Injun sand, very hard, (gas, 2075′)	90	2165
Unrecorded	250	2415
Berea Grit	15	2430
Unrecorded	350	2780
Gordon Stray	20	2800
Unrecorded	2	2802
Gordon sand (oil, 2802′; 2810′)	15	2817
Unrecorded to bottom	36	2853

10″ casing, 316′; 8″ casing, 1292′; 6⅝″ casing, 2031′; 5 3/16″ casing, 2061½′.

A light gas pay was struck in the Big Injun sand, but the well is too close to the axis of the Robinson syncline to expect a paying gas well at any horizon.

Passing to the western slope of the Arches Fork anticline in McClellan district, a great oil pool in the Big Injun sand is found extending entirely across the latter area. This field is merely an extension of the Arches Fork field of Wetzel county, and was the earliest opened in Doddridge county. The record of the first well in the field and also the first oil well in the county, drilled on the Sullivan Heirs farm early in 1892, is given in connection with the section for Centerpoint, page 72. Taking up the development of this oil pool from the Tyler-Doddridge county line southwestward, the following is the record of a well on the dividing ridge on the extreme head of Beverlin fork:

J. B. Dewhurst No. 1 Well Record (50).

Located in Grant District, Wetzel County, 0.9 mile S. 15° W. of Arches. Authority, South Penn Oil Company.

(Elevation, 1330′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1530	1530
Sand, Dunkard? (I Cow Run)	12	1542
Slate and shells	123	1665
Gas? sand (Burning Springs)	45	1710
Slate and shells	80	1790
Sand, Salt? (Gas, II Cow Run and Salt)	245	2035
Break	30	2065
Unrecorded	35	2100
Salt sand	30	2130
Red rock	125	2255
Slate	80	2335
White lime	55	2390
Black sand, (Keener)	20	2410
Big Injun sand (gas, 2462′; oil, 2478′)	87	2497
Slate to bottom	10	2507

The Pittsburgh coal was not recorded and is probably absent, since, owing to its importance as a key rock, it is always noted in the driller's log. Its horizon belongs at about 1060 feet in the well.

Meagre records of the following wells in this pool are given in the table for Doddridge county: J. B. Dewhurst No. 18 (51), Emeline Snodgrass No. 1 (56), Sydney

Joseph Nos. 1 and 2 (58 and 59), Jos. Underwood No. 1 (63), and Geo. Cumberledge No. 2 (68). None of the well records gives any data as to initial production.

The two following records, though very incomplete, convey information as to the depth the oil and gas pays were encountered:

M. J. Yeater No. 1 Well Record (62).

Located in McClellan District, 1.5 miles north of Centerpoint. Authority, South Penn Oil Company.

(Elevation, 845′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1920	1920
Big Injun sand (gas, 1930′, 1950′; oil, 2004′) and unrecorded to bottom	112	2032

Lowndes and Hart No. 11 Well Record (65).

Located in McClellan District, 1.5 miles northeast of Centerpoint. Authority, South Penn Oil Company. Completed Aug. 6, 1895.

(Elevation, 975′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	660	660
Pittsburgh coal and unrecorded	1350	2010
Big Injun sand (gas, 2101′; oil, 2110′) and unrecorded	129	2139

Conductor, 18′; 10″ casing, 185′; 8¼″ casing, 1256′; 6⅝″ casing, 1630; 5$\frac{3}{16}$″ casing, 439′.

Shot July 25, 1896, 16 quarts. Top of shot, 2106′.

The three following records of wells in this field were published on pages 331 and 329 of Vol. I of the State Survey reports, respectively. The edition of the latter report is exhausted, and since they contain much more detail than was possible in later wells, they are here re-published:

George Cumberledge No. 1 Well Record (67).

Located in McClellan District, one-fourth mile southeast of Centerpoint. Authority, South Penn Oil Company.

(Elevation, 795′ B-A. T.)	Thickness. Feet.	Total. Feet.
Conductor	36	36
Limestone	30	66
Slate	20	86
Limestone and slate	180	266
Limestone (?) **Pittsburgh coal** at bottom	174	440

PLATE IX.—Stout Oil Field and Farm on which First Well was drilled. Another view of the Topography of the Dunkard series.

	Thickness. Feet.	Total. Feet.
Limestone and sand (water)	25	465
Slate, black	50	515
Red rock	35	550
Slate	180	730
Red rock	250	980
Big Dunkard sand	35	1015
Slate	40	1055
Sand, Lower Freeport (Gas sand) (water)	150	1205
Slate	90	1295
Sand, Salt (II Cow Run and Salt)	221	1516
Red rock and limestone	203	1719
Pencil slate and limestone (Mountain) (Big Lime)	68	1787
Big Injun sand (oil, 1789'; gas, 1865')	113	1900
Slate, black	34	1934
Sand, black and gray	25	1959
Slate	50	2009
Sand, black (Squaw)	100	2109
Slate	25	2134
Limestone	35	2169
Sand, gray (Berea)	41	2210
Slate and shells	90	2300
Sand, black, Gantz	45	2345
Slate	10	2355
Sand, hard, gray, Fifty-foot	20	2375
Slate and sand shells	116	2491
Red sand, (Thirty-foot)	15	2506
Slate and shells	55	2561
Sand, white, Thirty-foot. (Gordon Stray) (gas, 2561')	10	2571
Slate	40	2611
Slate and limy shells to bottom	269	2880

10" casing, 266'; 8¼" casing, 1000'; 6⅝" casing, 1200'; 5 3/16" casing, 1788'.

The well starts 95 to 100 feet below the Washington coal bed.

Mahala Sweeney No. 1 Well Record (73).

Located in McClellan District, 1¼ miles N. 80° W. of Centerpoint. Authority, South Penn Oil Company. Completed in 1894.

(Elevation, 765' B-A. T.)	Thickness. Feet.	Total. Feet.
Rock	29	29
Red rock	31	60
Slate	29	89
Sand, Gilboy	15	104
Red rock	27	131
Slate	21	152
Limestone (trace of coal, Uniontown)	33	185
Sand	35	220
Unrecorded	88	308
Slate and shells	106	414
Coal, (Sewickley)	3	417
Slate	35	452

		Thickness. Feet.	Total. Feet.
Limestone		21	473
Coal, Pittsburgh		4	477
Slate		13	490
Sand, (Lower Pittsburgh)		78	568
Slate		32	600
Sand, (Minshall)		28	628
Limestone		67	695
Red rock		24	719
Limestone		25	744
Red rock		83	827
Limestone		48	875
Slate		26	901
Limestone		64	965
Slate		15	980
Limestone		85	1065
Sand, Dunkard? Mahoning (Burning Springs)		84	1149
Slate		14	1163
Sand		21	1184
Limestone		16	1200
Gas sand (Freeport)		66	1266
Slate		35	1301
Sand, Salt? (II Cow Run)	90'	283	1584
Slate	15		
Sand, (Salt)	104		
Slate and shell	64		
Sand	10		
Limestone		56	1640
Red rock		32	1672
Limestone		39	1711
Slate		3	1714
Limestone		30	1744
Slate, Pencil		4	1748
Limestone, Mountain (Big Lime)		69	1817
Big Injun sand (gas and oil, 1832'; break, 1903'; gas, 1911'; first pay, 1924'; salt water, 1929')		112	1929

The well starts 50 below the Washington coal bed. Three coals are recorded in the well. The interval between the Sewickley and Pittsburgh coals—56 feet—appears short as compared to the same interval (77 feet) in the J. Hudson diamond drill boring (21) used in connection with the Sedalia section, page 70.

The detailed log of the Samuel Collins No. 3 well (70), located 0.7 mile west of Centerpoint, on the south bank of McElroy creek, is published on pages 281-282 of Vol. I(A) of the State Survey reports. The well starts 60 feet below the Washington coal; hence, the 3 feet of coal at 168 feet correlates with the Uniontown.

After crossing McElroy creek, this Big Injun sand oil pool swerves more to the west as do also the structure contours of the Pittsburgh coal (See map accompanying this report), and at Ashley it has almost doubled its width to the northeast of Centerpoint. The following records are from a well on Riggins run, and another at the mouth of Ralphs run, both producing oil from the Big Injun sand:

J. H. Ash No. 1 Well Record (75).

Located in McClellan District, 1¼ miles south of Ashley. Authority, South Penn Oil Company. Completed in 1895.

(Elevation, 800' L-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1100	1100
Sand, Dunkard? (Moundsville) and unrecorded	845	1945
Big Injun sand (oil)	113	2058
Unrecorded	612	2670
Gordon sand	20	2690
Slate	48	2738
Hard sand (Fourth)	3	2741
Slate to bottom	167	2908

The well starts 35 feet, hand-level measurement, below the Washington coal; hence, the Pittsburgh coal horizon belongs at 485 feet in the well.

Israel Allen No. 1 Well Record (79).

Located in McClellan District, 1.1 miles east of Eagle Mills. Authority, Jennings Oil Company. Completed June 1, 1897.

(Elevation, 748' L-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	500	500
Coal, Pittsburgh? (Redstone) and unrecorded	1319	1819
Big Injun sand (first show of black oil, 1837'; good pay, 1847') and unrecorded to bottom	116	1935
6⅝" casing, 1740'.		

The well starts flush with the base of the Washington coal; hence, the coal recorded at 500 feet most likely correlates with the Redstone and not the Pittsburgh, since the latter comes 520 to 530 feet below the Washington coal in northern Doddridge.

Passing to the west side of the axis of the Burchfield Basin another Big Injun sand oil pool is found extending along the Doddridge-Tyler county line entirely across Mc-

Clellan district. This pool is merely an extension of the old Stringtown field of Tyler county. The first wells were drilled by Murphy & Jennings in 1895 on the Hardman farm, and for that reason it was known as the **Hardman pool.** The first well produced at the rate of 500 barrels daily.

The five following records are from wells in this field:

Silas Langfitt No. 4 Well Record (80).

Located in McClellan District, at Eagle Mills. Authority, South Penn Oil Company. Completed September 21, 1893.

(Elevation, 743' L-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	444	444
Coal, Pittsburgh? (Redstone) and unrecorded	1359	1803
Big Injun sand, (first oil pay 1870'; second oil pay, 1880') and unrecorded	97	1900

10" casing, 473'; 8¼" casing, 973'; 6⅝" casing, 1805'.

The well starts only 20 to 25 feet below the Washington coal bed; hence, the coal at 444 feet, identified by the driller as the Pittsburgh bed, must correlate with the Redstone coal, 30 to 50 feet higher in the measures. The same error was made in all these wells in the western portion of McClellan district, as discussed at length in the chapter on structure, page 52. The first oil pay occurs near the top of the sand, while the second comes 10 to 50 feet lower down.

Silas Langfitt No. 7 Well Record (81),

Located in McClellan District, ¼ mile west of Eagle Mills. Authority, South Penn Oil Company. Completed Dec. 18, 1893.

(Elevation, 748' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	470	470
Coal, Pittsburgh? (Redstone) and unrecorded	530	1000
Big Dunkard sand	40	1040
Unrecorded	766	1806
Big Injun sand (gas and show of oil, 1868'; oil, 1871') and unrecorded	86	1892

10" casing, 453'; 8¼" casing, 958'; 6⅝" casing, 1823'.

The well starts about 15 feet below the Washington coal.

W. B. Allen No. 7 Well Record (87).

Located in McClellan District, one mile northeast of Eagle Mills. Authority, Jennings Oil Company. Completed, August 12, 1896.

(Elevation, 825′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	500	500
Coal, Pittsburgh? (Redstone) and unrecorded	1315	1815
Big Injun sand (first oil and gas, 1890′) and unrecorded to bottom	153	1968
6⅝″ casing, 1832′.		

Benton Allen No. 5 Well Record (82).

Located in McClellan District, one mile north 30° east of Eagle Mills. Authority, Jennings Oil Company. Completed Oct. 30, 1895.

(Elevation, 780′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	570	570
Coal, Pittsburgh, and unrecorded	1288	1858
Big Injun sand (first gas and oil, 1938′; good sand, oil pay, 1948′; salt water, 1966′) and unrecorded to bottom	108	1966
6⅝″ casing, 1858′.		

O. W. O. Hardman No. 25 Well Record (83).

Located in McClellan District, one mile and a half north 15° east of Eagle Mills. Authority, Jennings Oil Company. Completed Oct. 4, 1896.

	Thickness. Feet.	Total. Feet.
Unrecorded	740	740
Pittsburgh coal and unrecorded	1290	2030
Big Injun sand (small show of oil, 2133′; second pay, 2148′-2153′) and unrecorded to bottom	152	2182
10″ casing, 40′; 6⅝″ casing, 2000′.		

The two following records are from Gordon sand oil wells located near the axis of the Burchfield Basin, on the headwaters of Elk Lick run. These wells are an extension to the southwest of the old Stringtown Gordon sand oil pool of Tyler county. The records are so incomplete that it is not possible to determine whether or not the coal identified by the drillers as the Pittsburgh represents that bed or the Redstone. In any event the coal does not appear to be of any economic importance:

O. W. O. Hardman No. 54 Well Record (85)

Located in McClellan District, 1¼ miles south of Stringtown. Authority, Jennings Oil Company. Completed June 13, 1898.

(Elevation, 1200' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1014	1014
Pittsburgh coal and unrecorded	1290	2304
Big Injun sand	206	2510
Unrecorded	540	3050
Stray sand and unrecorded	20	3070
Gordon sand oil pay	11	3081
Unrecorded to bottom	9	3090

10" casing, 308'; 8¼" casing (pulled), 1480'; 6⅝" casing, 2418'; $5\frac{3}{16}$" casing, 2500'.

Lloyd McIntyre No. 1 Well Record (86).

Located in McClellan District, 1.5 miles south 30° east of Stringtown. Authority, Jennings Oil Company. Completed Jan. 8, 1895.

(Elevation, 985' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	742	742
Pittsburgh coal and unrecorded	1290	2032
Big Injun sand	203	2235
Unrecorded	565	2800
Stray sand and unrecorded	30	2830
Gordon sand, oil pay	5	2835
Slate to bottom	7	2842

10" casing, 230'; 8¼" casing, 1190'; 6⅝" casing, 2260'; $5\frac{3}{16}$" casing, 2309'.

Prospective Oil and Gas Territory, McClellan District.—There yet remains quite a large acreage of undrilled territory in McClellan district that appears to be within defined limits or is favorably located for oil and gas. (1) That, westward from the mouth of Ralphs run to Eagle Mills, looks favorable for both Big Injun and Gordon oil; (2) that, on the head waters of Riggins and Little Battle runs, looks good for Big Injun and Gordon gas; and (3) that, 2 miles northeast of Sedalia, northeast from the Eliza J. Webb No. 1 well (35) looks favorable for Gordon sand oil. (4) The territory immediately north and northwest from Ashley would justify the drilling of more test wells.

GRANT DISTRICT.

Grant district lies southwest from McClellan, and extends in a northwest-southeast direction entirely across Doddridge county. Like the latter district, Grant is traversed in a northeast-southwest direction by three pronounced structural folds; viz., the Burchfield syncline, the Arches Fork anticline, and the Robinson syncline. In this district both the synclinal basins are occupied by large oil fields, and the much widened crest of the anticlinal arch by a great gas field in the Big Injun, Gordon and Fifth sands. A glance at the contours of the Pittsburgh coal bed as exhibited on the economic geology map accompanying this report, will show that the axis of the latter fold rises in elevation rapidly southwestward through Grant, and has broadened out on top, making a terrace structure three to four miles in width. The latter feature has much increased the available area of gas territory in the district. The oil and gas pools therein will now be discussed from northwest to southeast.

The Big Injun sand oil pool of the Eagle Mills region of McClellan district extends southwestward along the axis of the Burchfield Basin almost entirely across Grant. The rapid rise of the axis of this basin to the southwest from Flint run has no doubt been instrumental in terminating development in this direction before reaching the Grant-West Union district line. The six following records from about 100 oil wells in this portion of Grant fail to record any water in the Big Injun sand. This absence of water no doubt accounts in a large measure for the exceptional presence of an oil pool at this horizon in a synclinal basin, as this sand generally contains a large amount of salt water which, owing to its greater specific gravity, forces the oil up out of the troughs along the adjacent slopes of the synclinal fold:

Chas. Stewart No. 7 Well Record (88)

Located in Grant District, 1 mile southwest of Eagle Mills. Authority, South Penn Oil Company. Completed Dec. 23, 1895.

(Elevation, 748' L-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	415	415
Coal, Pittsburgh? (Redstone), and unrecorded	1381	1796
Big Injun sand and unrecorded (oil pay, 1803')	79	1875

10" casing, 315'; 8¼" casing, 950'; 6⅝" casing, 950'; 5$\frac{3}{16}$" casing, 1804'.

The well starts 24 feet by hand-level below the Washington coal bed; hence, the coal at 415 feet identified by the driller as the Pittsburgh, must correlate with the Redstone bed.

John D. McReynolds No. 4 Well Record (91).

Located in Grant District, one mile northeast of Canton. Authority, South Penn Oil Company. Completed Oct. 11, 1893.

(Elevation, 760' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	429	429
Coal, Pittsburgh? (Redstone) and unrecorded	1377	1806
Big Injun sand (light gas, 1815'; oil show, 1821')	99	1905
Slate and shells	55	1960
Unrecorded	559	2519
Sand, Gordon? (oil show, 2529') (Gordon Stray)	15	2534
Unrecorded to bottom	47	2581

10" casing, 535'; 8¼" casing, 957'; 5⅝" casing, 1741'.

The well starts 40 feet by aneroid below the Washington coal; hence, the coal at 429 feet correlates with the Redstone and not the Pittsburgh. A show of oil has been encountered in the Gordon Stray, and not the Gordon as identified by the driller. In this region the latter sand comes 750 to 800 feet below the top of the Big Injun sand, as exhibited by the wells (84, 85 and 86) three miles to the northeast. As additional evidence that the oil show occurs in the Gordon Stray, and that the coal at 429 feet represents the Redstone bed, the reader is referred to the detailed record of the J. D. McReynolds No. 1 well (89) one-half mile to the northwest, published in connection with the section for Canton, page 75.

Silas Ash No. 2 Well Record (93).

Located in Grant District, at Canton. Authority, South Penn Oil Company. Completed July 20, 1893.

(Elevation, 805′ L-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	495	495
Pittsburgh coal and unrecorded	1365	1850
Big Injun sand (pay, 1930′) and unrecorded to bottom	107	1957

10″ casing, 330′; 8¼″ casing, 1025′; 6⅝″ casing, 1815′.
Shot Jan. 19, 1895, 12 quarts. Top of shot, 1927′.
Shot Oct. 15, 1901, 30 quarts. Top of shot, 1928′.
Shot Oct. 28 1904, 40 quarts. Top of shot, 1928′.
Shot Dec. 22, 1906, 60 quarts. Top of shot, 1930′.

The well starts 10 feet by hand-level below the Washington coal bed; hence, the driller correctly identified the coal at 495 feet. The Washington-Pittsburgh coal interval is much more reliable in correlating the coals of the Monongahela series, than the Pittsburgh coal-Big Injun sand interval.

Henry Knight No. 1 Well Record (95).

Located in Grant District, ¾ mile west of Canton. Authority, South Penn Oil Company. Completed Dec. 16, 1893.

(Elevation, 865′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	556	556
Pittsburgh coal and unrecorded	594	1150
Dunkard sand and unrecorded	742	1902
Big Injun sand and unrecorded (gas and oil show, 1977′; oil, 1990′)	111	2013

10″ casing, 358′; 8¼″ casing, 1100′; 6⅝″ casing, 1878′.

Charles Doak No. 1 Well Record (96).

Located in Grant District, 1 mile west of Canton. Authority, South Penn Oil Company. Completed Sept. 13, 1894.

(Elevation, 940′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	628	628
Pittsburgh coal and unrecorded	1840	1968
Big Injun sand and unrecorded (gas, 2050′; oil, 2061′)	112	2080

10″ casing, 251′; 8¼″ casing, 1020′; 6⅝″ casing, 1244′; 5$\frac{3}{16}$″ casing, 1980′.

Jacob Underwood No. 11 Well Record (97).

Located in Grant District, 1.5 miles southwest of Eagle Mills. Authority, South Penn Oil Company. Completed Aug. 30, 1898.

(Elevation, 1280' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	950	950
Pittsburgh coal and unrecorded	1340	2290
Big Injun sand (oil pay, 2374') and unrecorded	119	2409

10" casing, 200'; 8¼" casing, 1419'; 6⅝" casing, 2238'.
Shot Sept. 1, 1898, 30 quarts. Top of shot, 2372'.
Shot Dec., 1899, 30 quarts. Top of shot, 2372'.
Shot Feb. 22 1905, 40 quarts. Top of shot, 2374'.

Along the extreme northwest border of Grant district, 1.5 miles northwest from Canton, there occurs a small oil pool in the Maxton sand on the Costilow farm. The W. A. Costilow No. 1 well (98) therein had an initial production of 25 barrels daily. The writer was not able to obtain the records of any wells in this pool.

One mile southwest of this Maxton oil pool there occurs a gas well in the Big Injun sand on the Wm. Sandy farm, the summarized record of which is published under No. 160 in the table of wells for Tyler county, pages 482-483 of the Marshall-Wetzel-Tyler Report of the State Survey.

The great gas field of Grant district extends southeast from Canton to Numan near the head of Buckeye run on the high structural levels of the Arches Fork anticline. The John McReynolds No. 1 well (92), located near the Grant-McClellan district line, 1.8 miles northeast from Alpha, and drilled about 20 years ago, was probably the first well in the district. It was an enormous gasser from probably the Big Injun sand, but at that time a gas well was considered the same as a dry hole. The casing was pulled and the well abandoned and since that time it burned in the open air until 1909, excavating an immense hole in the ground.

The following is an interesting record of a well located 1.3 miles southwestward, in that the minute and rock pressure is given of what is possibly the gas pay in the Big Injun sand, since it is quite probable that a test of the Fifth sand gas would show a higher rock pressure:

Emma Hoskinson No. 2079 Well Record (102A).

Located in Grant District, ¾ mile north of Alpha. Authority, Philadelphia Company. Completed May 24, 1911.

	Thickness. Feet.	Total. Feet.
Unrecorded	320	320
Coal, native, (Uniontown)	3	323
Unrecorded	252	575
Coal, Pittsburgh? (Redstone)	5	580
Unrecorded	302	882
Sand, Little Dunkard? (Grafton)	38	920
Unrecorded	65	985
Sand, Big Dunkard?	20	1005
Salt sand **Maxton sand** **Big Lime** } Shells; no Big Lime	1067	2072
Big Injun sand (gas, 2191′)	183	2255
Unrecorded	3	2258
Squaw sand	65	2323
Unrecorded	157	2480
Sand, Fifty-foot? (Berea)	40	2520
Unrecorded	20	2540
Sand, Thirty-foot? (Gantz)	60	2600
Unrecorded	300	2900
Fifth sand (gas, 2908′)	12	2912
Unrecorded to bottom	4	2916

10″ casing, 388′; 8¼″ casing, 1277′; 6⅝″ casing, 2072′.

Pressure in 6⅝″ casing:

1st ⅓ minute, 10 lbs.
1st minute, 25 lbs.
2nd minute, 45 lbs.
5th minute, 100 lbs.
10th minute, 175 lbs.
15th minute, 230 lbs.
30th minute, 295 lbs.
Rock pressure, 12 hours, 375 lbs.

The following are Big Injun sand gassers, and their summarized records are given in the table of wells for Doddridge county: Samuel B. McMillan No. 1 (102), located one-fourth mile north of Alpha; M. A. McMillan No. 1 (103), located 0.6 mile due east of Alpha; and C. I. McMillan No. 1 (104), located 1.3 miles southeast of Alpha.

The three following records are from wells located on a northwest nose of the Arches Fork anticline, on the waters of Israel fork:

S. B. McMillan No. 1 Well Record (105)

Located in Grant District, one-half mile southeast of Alpha. Authority, Carter Oil Company. Completed Feb. 28, 1898.

(Elevation, 815′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	370	370
Coal, Pittsburgh? (Redstone)	6	376
Unrecorded	524	900
Sand, Cow Run, (Big Dunkard)	20	920
Unrecorded	5	925
Sand, Salt? (Burning Springs and "Gas")	250	1175
Unrecorded	495	1670
Big Lime	90	1760
Keener sand	5	1765
Big Injun sand (strong gas, 1790′)	95	1860

The well starts about 100 feet below the Washington coal; hence, the coal at 370 feet represents the Redstone. The great sand mass at 925 feet all belongs in the Allegheny series, and not the Pottsville. The driller has evidently failed to record the parting shales and slates, since no such thickness of continuous sandstone was observed in the logs of surrounding wells.

Martin V. Underwood No. 2 Well Record (106).

Located in Grant District, 1¼ miles southwest of Alpha. Authority, J. E. Trainer. Completed Nov. 15, 1909.

(Elevation, 1130′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded (water, 70′)	210	210
Native coal, (Waynesburg "A")	2	212
Unrecorded	478	690
Pittsburgh coal	3	693
Unrecorded	437	1130
Sand, Little Dunkard (I Cow Run)	20	1150
Unrecorded	80	1230
Big Dunkard sand	30	1260
Unrecorded	65	1325
Gas sand	35	1360
Unrecorded	21	1381
Sand, Salt? (Clarion)	64	1445
Unrecorded	75	1520
Sand, Salt? (II Cow Run)	60	1580
Unrecorded	45	1625
Salt sand (water, 1630′; 2 bailers per hour)	50	1675
Unrecorded	120	1795
Sand, **(Salt)**	60	1855
Unrecorded	35	1890
Maxton sand	60	1950

Little lime	20	1970
Pencil cave	15	1985
Blue Monday	36	2021
Big Lime	46	2067
Big Injun sand (some gas at 2089′ and 2157′)	123	2190
Unrecorded.	16	2206
Squaw sand	19	2225
Unrecorded	115	2340
Sand, Gantz? (Berea)	110	2450
Unrecorded	125	2575
Fifty-foot sand	35	2610
Unrecorded	65	2675
Thirty-foot sand	25	2700
Unrecorded	84	2784
Stray sand (gas, 2792′)	10	2794
Unrecorded	19	2813
Gordon sand (gas, 2815′)	9	2822
Unrecorded to bottom	18	2840

10″ casing, 255′; 8¼″ casing, 1381′; 6⅝″ casing, 2021′.

Chas. Shrader No. 1 Well Record (107).

Located in Grant District, 1.1 miles east of Knight. Authority, Carter Oil Company. Completed Nov. 8, 1909.

(Elevation, 1110′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	600	600
Coal, Pittsburgh? (Redstone)	4	604
Unrecorded	236	840
Cave	85	925
Sand, Cow Run? (Grafton)	25	950
Cave	130	1080
Sand, Cow Run (I Cow Run)	15	1095
Unrecorded	215	1310
Sand, Salt? ("Gas")	55	1365
Unrecorded	5	1370
Sand, Salt? (II Cow Run)	70	1440
Unrecorded	20	1460
Salt sand (water)	40	1500
Unrecorded	305	1805
Maxton sand (gas, 1855′; oil, 1855′-1860′)	90	1895
Unrecorded	35	1930
Cave	15	1945
Big Lime	75	2020
Big Injun sand (gas, 2045′-2046′)	75	2095
Unrecorded	225	2320
Squaw sand	80	2400
Unrecorded	50	2450
Berea sand	2	2452
Unrecorded	250	2702
Gordon Stray	8	2710
Unrecorded	9	2719
Gordon sand (gas, 2725′-2727′)	8	2727

10″ casing, 310′; 8¼″ casing, 1190′; 6⅝″ casing, 1954′.

Gas was encountered at three horizons; viz., Maxton, Big Injun, and Gordon. A small oil showing was struck near the middle of the Maxton.

The two following records are from wells located on the main branch of Flint, southeast from Israel fork:

M. A. McMillan No. 2 Well Record (103).

Located in Grant District, 0.7 mile east of Alpha. Authority, J. E. Trainer. Completed in June, 1910.

(Elevation, 860′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	387	387
Coal, Pittsburgh? (Sewickley)	3	390
Unrecorded	550	940
Big Dunkard sand	18	958
Unrecorded	62	1020
Sand, "Gas"? (Burning Springs)	98	1118
Unrecorded	47	1165
Sand, Salt? ("Gas")	35	1200
Unrecorded	30	1230
Sand, Salt (II Cow Run and Salt)	255	1485
Unrecorded	65	1550
Salt sand (gas show, 1570′)	40	1590
Unrecorded	45	1635
Maxton sand	20	1655
Unrecorded	30	1685
Little lime	18	1703
Pencil cave	12	1715
Sand, Blue Monday	52	1767
Big Lime	53	1820
Big Injun sand (gas, 1883′ and 1893′)	130	1950
Unrecorded to bottom	50	2000

10″ casing, 285′; 8¼″ casing, 1056′; 6⅝″ casing, 1750′.

The well starts 60 feet below the Washington coal bed. The top of the Big Lime has become very hard and sandy, and for that reason has been designated the **Blue Monday**.

C. I. McMillan No. 1 Well Record (104).

Located in Grant District, 1.5 miles northwest of Flint. Authority, J. E. Trainer. Completed in 1910.

(Elevation, 845′ A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded (water, 30′)	120	120
Native coal, (Uniontown) and unrecorded	242	362
Coal, Pittsburgh? (Sewickley)	5	367
Unrecorded	413	780
Sand, Little Dunkard	126	906

	Thickness. Feet.	Total. Feet.
Unrecorded	74	980
Sand, "Gas"? (Big Dunkard and Burning Springs)	135	1115
Unrecorded	5	1120
Coal, (Upper Kittanning)	2	1122
Unrecorded	13	1135
Sand, Salt? ("Gas" and Clarion)	125	1260
Unrecorded	15	1275
Sand, Salt? (II Cow Run and Salt)	105	1380
Unrecorded	35	1415
Salt sand	37	1452
Unrecorded	58	1510
Maxton sand	100	1610
Unrecorded	30	1640
Little lime	20	1660
Pencil cave	15	1675
Unrecorded	25	1700
Blue Monday	19	1719
Big Lime	74	1793
Big Injun sand (gas, 1805′ and 1878′)	90	1883
Unrecorded	2	1885
Squaw sand and unrecorded to bottom	12	1897

10″ casing, 255′; 8¼″ casing, 876′; 6⅝″ casing, 1725′.

The well starts 100 feet below the Washington coal.

The four following records are from wells located on East and Howell runs of Flint run, a short distance west of the axis of the Arches Fork anticline. In these wells the main gas horizon is the Big Injun sand, although Nos. 113 and 114 report a gas pay in the Maxton:

Mary V. Snider No. 1462 Well Record (111).

Located in Grant District, 1.5 miles northeast of Flint. Authority, Hope Natural Gas Company. Completed in 1910.

(Elevation, 1305′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	365	365
Coal, native (Washington)	2	367
Unrecorded	519	886
Coal, Pittsburgh	6	892
Unrecorded	439	1331
Sand, Little Dunkard (I Cow Run)	20	1351
Unrecorded	74	1425
Big Dunkard sand	25	1450
Unrecorded	100	1550
Gas sand	40	1590
Unrecorded	170	1760
First Salt sand	45	1805
Unrecorded	10	1815
Second Salt sand	145	1960
Unrecorded	120	2080

	Thickness. Feet.	Total. Feet.
Maxton sand	30	2110
Unrecorded	35	2145
Little lime	15	2160
Pencil cave	6	2166
Big lime	54	2220
Big Injun sand (gas, 2294')	111	2331
Unrecorded	29	2360
Squaw sand	80	2440
Unrecorded	115	2555
Sand, Gantz? (Berea)	5	2560
Unrecorded	170	2730
Fifty-foot sand	30	2760
Unrecorded	120	2880
Thirty-foot sand	20	2900
Unrecorded	10	2910
Gordon Stray sand	15	2925
Unrecorded	15	2940
Gordon sand	20	2960
Unrecorded	40	3000
Fourth sand	5	3005
Unrecorded	145	3150
Fifth sand	18	3168
Unrecorded to bottom	232	3400

The log fails to report whether or not any gas was encountered in the deep sands below the Big Injun. The Gordon and Gordon Stray are usually productive along the crest of this fold to the northeast in McClellan district. An accurate measurement is given for the Washington-Pittsburgh coal interval—519 feet—for northern Doddridge, justifying the writer's assumption of 520 feet for the same in making the structure map for this portion of Doddridge county.

L. O. Kester No. 1 Well Record (112A).

Located in Grant District, ¾ mile northeast of Flint. Authority, Pennsylvania Oil & Gas Company.

(Elevation, 895' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	462	462
Pittsburgh coal	5	467
Unrecorded	383	850
Sand, Little Dunkard? (Moundsville)	20	870
Unrecorded	115	985
Big Dunkard sand	61	1046
Unrecorded	64	1110
Gas sand	30	1140
Unrecorded	10	1150
Sand, (Clarion)	40	1190

	Thickness. Feet.	Total. Feet.
Unrecorded	10	1200
Sand, Salt (II Cow Run)	40	1240
Unrecorded	66	1306
Salt sand	82	1388
Unrecorded	12	1400
Salt sand	140	1540
Unrecorded	75	1615
Maxton sand	25	1640
Unrecorded	44	1684
Little lime	16	1700
Unrecorded	41	1741
Pencil cave	5	1746
Big Lime	56	1802
Big Injun sand (gas, 1819')	106	1908
Unrecorded to bottom	2	1910

10" casing, 218'; 8" casing, 1550'; 6⅝" casing, 1800'; 2" tubing, 1910'.

"Well made 3,000,000 cubic feet of gas daily from Big Injun sand on an open flow test in June, 1911."

The well starts 60 feet below the Washington coal. Its rock pressure on August 5, 1911, was 345 pounds per square inch.

H. T. Powell No. 1467 Well Record (113).

Located in Grant District, ¾ mile southwest of Flint. Authority, Hope Natural Gas Company. Completed in 1910.

(Elevation, 1000' B-A. T.)
Steel line measurement.

	Thickness. Feet.	Total. Feet.
Unrecorded	234	234
Coal, native (Uniontown)	17	251
Unrecorded	278	529
Coal, Pittsburgh	3	532
Unrecorded	358	890
Sand, Little Dunkard (Moundsville)	30	920
Unrecorded	60	980
Sand Big Dunkard? (I Cow Run)	12	992
Unrecorded	208	1200
Gas sand	80	1280
Unrecorded	10	1290
Sand, Salt? (II Cow Run), (water, 1310'; 14 bailers per hour)	20	1310
Unrecorded	130	1440
Salt sand	110	1550
Unrecorded	120	1670
Maxton sand (gas, 1693')	65	1735
Unrecorded	10	1745
Little lime	70	1815
Big lime	87	1902
Big Injun sand (gas and oil, 1908')	85	1987
Unrecorded	4	1991

	Thickness. Feet.	Total. Feet.
Squaw sand	44	2035
Unrecorded to bottom	20	2055

10" casing, 337'; 8¼" casing, 781'; 6⅝" casing, 1108'; 5$\frac{3}{16}$" casing, 1845'.

Well starts flush with Washington coal bed.

The Powell & Williams No. 1 Well (113A), located on Howell run, 1.3 miles southwest from Flint, is probably the largest Big Injun gasser in the district. This well was completed by the Pennsylvania Oil & Gas Company on March 19, 1911, which reports the initial rock pressure at 765 pounds to the square inch, and the volume, 15 to 18 million cubic feet daily in June, 1911. A test on August 5, 1911, gave a rock pressure of 720 pounds. The gas flow was encountered at a depth of 2054 feet.

The T. W. Powell No. 2012 well of the Hope Natural Gas Company, located on the east hill side of Howell run, sprays much oil with its gas from the Big Injun, that is caught in a drip pan and forced back up hill to an oil tank. The well is located, however, too near the crest of the Arches Fork anticline to expect a large oil pool.

Southwestward up Flint run from Flint P. O., there occurs some prolific gas territory. The four following records are from wells in this region.

B. D. Helmick No. 1476 Well Record (114).

Located in Grant District, ¾ mile southeast of Flint. Authority, Hope Natural Gas Company. Completed April 26, 1910.

	Thickness. Feet.	Total. Feet.
Unrecorded	538	538
Coal, Pittsburgh	16	554
Unrecorded	386	940
Little Dunkard sand	45	985
Unrecorded	50	1035
Big Dunkard sand	35	1070
Unrecorded	115	1185
Gas sand	47	1232
Unrecorded	42	1274
Gas sand	21	1295
Unrecorded	10	1305
Sand, Salt? (II Cow Run) (water at 1305')	40	1345
Unrecorded	77	1422

	Thickness. Feet.	Total. Feet.
Salt sand	33	1455
Unrecorded	215	1670
Maxton sand (gas at 1698')	46	1716
Unrecorded	68	1784
Little lime	21	1805
Pencil cave	10	1815
Big Lime	65	1880
Sand, Big Injun	138	2018
Unrecorded	3	2021
Sand, Squaw and unrecorded (gas, 2030')	14	2035

"Volume 38-10 mercury through 6⅝" casing."

The volume test is equivalent to a daily production of 16,750,000 cubic feet, showing this well to be an enormous gasser. It is only one-half mile west of the axis of Arches Fork anticline. The well starts flush with the Washington coal.

M. J. Carr No. 1 Well Record (115).

Located in Grant District, ¾ mile west of Doak P. O. Authority, Hope Natural Gas Company. Tubed and shut in March 18, 1901.

(Elevation, 866' L-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	380	380
Pittsburgh coal and unrecorded	500	880
Big Dunkard sand	45	925
Unrecorded	505	1430
Salt sand	60	1490
Unrecorded	170	1660
Big Lime	60	1720
Big Injun sand, (gas show, 1730'; strong gas, 1850')	140	1860
Unrecorded	420	2280
Fifty-foot sand	20	2300
Unrecorded	129	2429
Sand, (Gordon Stray)	7	2436
Slate	28	2464
Lime	10	2474
Lime and shells	46	2520
Sand, (Fourth)	5	2525
Lime	5	2530
Slate	5	2535
Lime and shells	55	2590
Slate	20	2610
Lime and shells	50	2660
Slate	42	2702
Lime	28	2730
Slate to bottom	5	2735

Susan Sadler No. 1 Well Record (117).

Located in Grant District, 1.2 miles north of Numan. Authority, Wheeling Natural Gas Company. Completed Oct. 22, 1909.

(Elevation, 980′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded (water, 70′)	190	190
Native coal, (Waynesburg "A")	3	193
Unrecorded	467	660
Coal, Pittsburgh	7	667
Unrecorded	433	1100
Little Dunkard sand	35	1135
Unrecorded	65	1200
Big Dunkard sand	30	1230
Unrecorded	105	1335
Sand, Salt? ("Gas")	40	1375
Unrecorded	165	1540
Salt sand	100	1640
Unrecorded	150	1790
Maxton sand	80	1870
Unrecorded	40	1910
Little lime	25	1935
Pencil cave	10	1945
Big Lime	45	1990
Big Injun sand (gas, 2007′)	135	2125
Unrecorded	115	2240
Sand, Gantz? (Berea)	120	2360
Unrecorded	115	2475
Berea Grit? (Gantz)	25	2500
Unrecorded	180	2680
Gordon Stray sand	15	2695
Unrecorded	45	2740
Gordon sand (gas, 2747′)	20	2760
Unrecorded to bottom	34	2794

10″ casing, 124′; 8¼″ casing, 1200′; 6⅝″ casing, 1975′; 2″ tubing to bottom. About 1,000,000 cubic feet of gas daily.

C. G. Davis No. 1 Well Record (116).

Located in Grant District, one mile south 80° east of Doak. Authority, Wheeling Natural Gas Company.

	Thickness. Feet.	Total. Feet.
Conductor	15	15
Unrecorded	25	40
Quick sand	8	48
Unrecorded	517	565
Pittsburgh coal	7	572
Unrecorded	20	592
Sand, Hurry Up? (Lower Pittsburgh)	45	637
Unrecorded	248	885
Red rock, (Pittsburgh)	25	910
Unrecorded	96	1006
Little Dunkard sand	20	1026

	Thickness. Feet.	Total. Feet.
Unrecorded	84	1110
Big Dunkard sand	40	1150
Unrecorded	231	1381
Sand, "Gas" (II Cow Run and Salt) (small gas show, 1458′)	194	1575
Unrecorded	3	1578
Sand, Salt, and (Maxton)	222	1800
Little lime	20	1820
Unrecorded	31	1851
Big Lime	49	1900
Big Injun sand	140	2040
Squaw sand	15	2055
Unrecorded	400	2455
Fifty-foot sand	35	2490
Thirty-foot sand	15	2505
Slate, lime and shells	83	2588
Stray sand	17	2605
Unrecorded	29	2634
Shells of sand	6	2640
Unrecorded	8	2648
Gordon sand (gas, 2650′)	7	2655
Slate, lime and shells to bottom	37	2692

Northwest from Long Run in Grant district there occurs a fine Big Injun sand gas pool on the waters of Buckeye and Long runs. The four following records are from wells in this field:

R. M. Orr No. 1 Well Record (119).

Located in Grant District, 2¼ miles northeast of Morgansville. Authority, R. M. Orr.

(Elevation, 1220′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	190	190
Coal, native (Washington)	5	195
Unrecorded	520	715
Pittsburgh coal	7	722
Unrecorded	368	1090
Sand, Little Dunkard? (Moundsville)	30	1120
Unrecorded	75	1195
Big Dunkard sand	15	1210
Unrecorded	165	1375
Gas sand	31	1406
Unrecorded	59	1465
Sand, Salt? (II Cow Run)	45	1510
Unrecorded	70	1580
Salt sand (water, 1615′)	90	1670
Unrecorded	50	1720
Salt sand	130	1850
Unrecorded	50	1900

	Thickness. Feet.	Total. Feet.
Maxton sand (oil)	30	1930
Unrecorded	45	1975
Little lime	20	1995
Pencil cave	5	2000
Big Lime	70	2070
Big Injun sand (gas, 2090') to bottom	80	2150

"Production, 500,000 to 1,000,000 cubic feet daily from Big Injun."

The record shows oil in the Maxton sand. The oil was not saved.

Tate Bros. No. 1 Well Record (120).

Located in Grant District, 1.5 miles northwest of Long Run. Authority, Wheeling Natural Gas Company. Completed Sept. 18, 1909.

(Elevation, 915' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	90	90
Native coal, (Uniontown)	3	93
Unrecorded	279	372
Pittsburgh coal	8	380
Unrecorded	420	800
Little Dunkard sand	12	812
Unrecorded	68	880
Big Dunkard sand	40	920
Unrecorded	88	1008
Gas sand	51	1059
Unrecorded	141	1200
Salt sand	355	1555
Unrecorded	63	1618
Maxton sand	17	1635
Unrecorded	37	1672
Little lime	15	1687
Pencil cave	4	1691
Big Lime	39	1730
Unrecorded	3	1733
Big Injun sand	105	1838
Unrecorded	2	1840
Squaw sand	20	1860
Unrecorded	166	2026
Sand, Gantz, (Berea)	20	2046
Unrecorded	366	2412
Sand, Gordon. (Gordon Stray)	18	2430
Lime and shells	263	2693
Bayard sand (oil show, 2695')	10	2703
Slate, lime and shells to bottom (dry)	422	3125

10" casing, 154'; 8¼" casing, 1241'; 6⅝" casing, 1695'.

A showing of oil is reported in what appears to be the Bayard or Sixth sand at 2323 feet below the top of the Pittsburgh coal.

H. Orrowhood Well Record (121).

Located in Grant District, ¾ mile northeast of Sherwood. Authority, Wheeling Natural Gas Company.

(Elevation, 860′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	46	46
Native coal, (Uniontown)	2	48
Unrecorded	275	323
Coal, Pittsburgh	6	329
Unrecorded	296	625
Sand, Little Dunkard? (Grafton)	15	640
Unrecorded	200	840
Big Dunkard sand	40	880
Unrecorded	70	950
Gas sand	60	1010
Unrecorded	90	1100
Sand, Salt? (II Cow Run and Salt)	355	1455
Unrecorded	117	1572
Maxton sand	10	1582
Unrecorded	13	1595
Little lime	25	1620
Pencil cave	5	1625
Big Lime	68	1693
Big Injun sand (very small show of gas, 1703′)	110	1803
Unrecorded	4	1807
Squaw sand	10	1817
Unrecorded to bottom	73	1890

Silas Cain No. 1 Well Record (122).

Located in Grant District, at Snow. Authority, Carter Oil Company. Completed Jan. 26, 1901.

(Elevation, 865′ L-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	675	675
Cave	60	735
Unrecorded	165	900
Sand (I Cow Run)	40	940
Unrecorded	260	1200
Sand, Salt? (II Cow Run and Salt)	200	1400
Unrecorded	230	1630
Big Lime	65	1695
Big Injun sand (gas, 1780′)	103	1798
Unrecorded to bottom	681	2479

10″ casing, 280′; 8¼″ casing, 952′; 6¼″ casing, 1651′.

Rock pressure, 275 lbs.

John Whalen No. 2 Well Record (123).

Located in Grant District, ¾ mile north of Long Run Station. Authority, W. W. Dunham, Parkersburg, W. Va. Completed June, 1910.

(Elevation, 1160' B-A. T.)	Thickness. Feet.	Total. Feet.
Surface and gravel	10	10
Lime	10	20
Red rock	30	50
White slate	25	75
Lime	10	85
Red rock	40	125
Lime	10	135
White slate	25	160
Red rock	55	215
Lime	5	220
Coal, (Washington)	2	222
White slate	28	250
Red rock	25	275
Sand	25	300
Red rock	50	350
White slate	50	400
Sand, (Gilboy)	20	420
White slate	30	450
Lime	10	460
Coal, Uniontown	6	466
White slate	34	500
Lime	40	540
White slate	30	570
Lime	30	600
Shale	50	650
Sand, (Lower Sewickley)	25	675
White slate	75	750
Lime	5	755
Coal, Pittsburgh	9	764
White slate	36	800
Sand	40	840
White slate	60	900
Lime	20	920
Sand	20	940
White slate	60	1100
Lime	40	1140
Sand, (Saltsburg)	40	1180
White slate	65	1245
Black shale	40	1285
Sand, (Big Dunkard)	75	1360
White slate	60	1420
Black shale	30	1450
Gas sand	55	1505
Black shale	75	1580
Sand, (II Cow Run)	55	1635
Black shale	30	1665
Sand (Salt)	60	1725
Slate	50	1775
Sand, (Salt)	125	1900

		Feet. Thickness.	Feet. Total.
Black shale		100	2000
Sand, (Maxton)		20	2020
Red rock		15	2035
White slate		15	2050
Big Lime		100	2150
Sandy lime	**Big Injun**	30	2180
Sand, gas, (Big Injun)		35	2215
Black lime		15	2230
Slate to bottom		12	2242

A dry hole was drilled on the north side ot the railroad at Long Run. The detailed log of the J. D. Crabtree No. 1 well, located on the south side of the railroad, 0.8 mile northwest of Long Run, is published in connection with the section for the latter place, page 77. The log fails to report either oil or gas.

The three following records are from wells in the Sherwood and Morgansville gas field:

W. A. Stutler No. 1 Well Record (128).

Located in Grant District, at Sherwood Station. Authority, Castle Brook Carbon Black Company.

(Elevation, 849′ L-A. T.)	Thickness. Feet.	Total. Feet.
Conductor	16	16
Unrecorded (water, 17′ and 80′)	254	270
Coal, Pittsburgh, and unrecorded	630	900
Sand, "Gas"? (Burning Springs)	75	975
Unrecorded	10	985
Sand, Salt? ("Gas")	115	1100
Unrecorded	8	1108
Sand, Salt? (II Cow Run and Salt)	116	1224
Slate	76	1300
Salt sand	15	1315
Unrecorded	55	1370
Sand, (Third Salt) (gas, 1375)	30	1400
Unrecorded	65	1465
Sand, Maxton?	15	1480
Unrecorded	70	1550
Little lime	26	1576
Pencil cave	7	1583
Sand, Blue Monday (Maxton), (steel line measurement).	20	1603
Big Lime	56	1659
Big Injun sand (gas, 1609′; 1685′)	30	1689
Break of shell	5	1694
Sand and unrecorded to bottom	74	1768

10″ casing, 200′; 8¼″ casing, 800′.

The well starts 6 feet below the Uniontown coal; hence, it may be that the coal at 270 feet represents the Redstone and not the Pittsburgh as given by the driller, since the Uniontown-Pittsburgh coal interval in this region is close to 300 feet.

Gordon Rush No. 1 Well Record (129A).

Located in Grant District, ½ mile southeast of Morgansville. Authority, Acme Carbon Company.

	Thickness. Feet.	Total. Feet.
Unrecorded	240	240
Coal, Pittsburgh	6	246
Unrecorded	494	740
Big Dunkard sand	30	770
Unrecorded	100	870
Gas sand	60	930
Unrecorded	15	945
Sand, Salt? (Clarion)	25	970
Unrecorded	50	1020
Sand, Salt (II Cow Run and Salt)	180	1200
Unrecorded	120	1320
Salt sand	40	1360
Unrecorded	75	1435
Maxton sand	10	1445
Unrecorded	10	1455
Red rock	10	1465
Lime	8	1473
Unrecorded	37	1510
Little lime	14	1524
Unrecorded	4	1528
Pencil cave	7	1535
Blue Monday sand	33	1568
Big Lime	56	1624
Big Injun (gas) to bottom of hole, (not drilled through sand)	16	1640

10″ casing, 196′; 8¼″ casing, 846′; 6⅝″ casing, 1560′.

"Initial volume of well was 7,000,000 cubic feet of gas daily."

Lewis Maxwell No. 2 Well Record (129).

Located in Grant District, at Sherwood Station. Authority, Castle Brook Carbon Black Company.

(Elevation, 815′ B-A. T.)

	Thickness. Feet.	Total. Feet.
Conductor	15	15
Unrecorded	397	412
Coal, Elk Lick	5	417
Unrecorded	191	608
Sand, (gas) (I Cow Run)	7	615
Unrecorded (water, 620′)	275	890
Coal, (Upper Kittanning)	5	895

	Feet. Thickness.	Feet. Total.
Unrecorded	295	1180
Sand, Maxton? (Salt) and unrecorded	272	1452
Big Lime	94	1546
Big Injun sand (gas, 1556')	74	1620
Unrecorded	150	1770
Hard sand (Squaw)	25	1795
Unrecorded	390	2185
Gordon sand to bottom	8	2193

10" casing, 220'; 8¼" casing, 690'; 6⅝" casing, 1461'.

Well starts 77 feet by hand-level below the Uniontown coal, according to Mr. Reger.

The gas wells are quite numerous between Sherwood and Smithton, and northeastward up Morgans run along the axis of the Arches Fork anticline. The Big Injun and Gordon sands are the main gas bearing horizons in this region.

Passing to the southeastern portion of Grant district, the Gordon sand oil pool of McClellan is found extending southwestward on the head of Buckeye and Long runs along the Robinson synclinal basin. Within the boundaries of Grant there are 55 to 60 wells in the pool. The five following records are from wells in this field:

Albert A. Davis No. 1 Well Record (137).

Located in Grant District, at Numan. Authority, South Penn Oil Company.

(Elevation, 995' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	742	742
Pittsburgh coal	8	750
Unrecorded	512	1262
Big Dunkard sand	28	1290
Unrecorded	110	1400
Gas sand	35	1435
Unrecorded	205	1640
Salt sand	80	1720
Unrecorded	260	1980
Pencil cave	5	1985
Big Lime	90	2075
Big Injun sand	110	2185
Unrecorded	505	2690
Fifty-foot sand	40	2730
Unrecorded	7	2737
Sand, (Thirty-foot)	30	2767
Sand shell	44	2811
Stray sand (gas, 2811')	19	2830

	Feet. Thickness.	Feet. Total.
Slate	19	2849
Gordon sand (oil, 2851')	15	2864
Slate to bottom	17	2881

M. Davisson No. 6 Well Record (138).

Located in Grant District, three-fourths mile east of Numan. Authority, South Penn Oil Company.

(Elevation, 1149' L-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	924	924
Coal, Pittsburgh, and unrecorded	446	1370
Big Dunkard sand and unrecorded	447	1817
Salt sand and unrecorded	383	2200
Big Lime	52	2252
Big Injun sand	80	2332
Unrecorded	644	2976
Stray sand	14	2990
Unrecorded	25	3015
Gordon sand (oil)	12	3027
Unrecorded to bottom	1	3028

Mary O'Connor No. 1 Well Record (136.)

Located in Grant District, ½ mile south of Numan. Authority, South Penn Oil Company.

	Thickness. Feet.	Total. Feet.
Unrecorded	1040	1040
Coal, Pittsburgh	6	1046
Unrecorded	517	1563
Big Dunkard sand	85	1648
Unrecorded	243	1891
Sand, Salt? (Il Cow Run)	85	1976
Unrecorded	352	2328
Big Lime	60	2388
Big Injun sand	110	2498
Unrecorded	589	3087
Stray sand	23	3110
Unrecorded	20	3130
Gordon sand (oil)	12	3142
Unrecorded to bottom	43	3185

Ellen Kirk No. 1 Well Record (134).

Located in Grant District, 1¾ miles southwest of Salem. Authority, South Penn Oil Company.

Elevation, 1365' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1120	1120
Pittsburgh coal	6	1126

	Thickness. Feet.	Total Feet.
Unrecorded	509	1635
Big Dunkard sand	60	1695
Unrecorded	345	2040
Salt sand	40	2080
Unrecorded	325	2405
Big Lime	70	2475
Big Injun sand	80	2555
Unrecorded	505	3060
Fifty-foot sand	15	3075
Unrecorded	90	3165
Gordon Stray sand	5	3170
Unrecorded	30	3200
Sand, Gordon (oil)	13	3213
Unrecorded to bottom	15	3228

John Hession No. 1 Well Record (135).

Located in Grant District, ½ mile southwest of Industrial. Authority, South Penn Oil Company.

(Elevation, 1330′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1070	1070
Pittsburgh coal	5	1075
Unrecorded	525	1600
Big Dunkard sand	55	1655
Unrecorded	475	2130
Salt sand	75	2205
Unrecorded	190	2395
Big Lime	60	2455
Big Injun sand	120	2575
Unrecorded	395	2970
Sand, Fifty-foot? (Gantz)	30	3000
Unrecorded	120	3120
Gordon Stray sand	12	3132
Unrecorded	29	3161
Gordon sand (oil)	12	3173
Unrecorded to bottom	47	3220

The oil does not rise over 50 feet in elevation above the structural level of the axis of the Robinson Basin on the western border of this Gordon sand oil pool of Grant and McClellan districts; and the gas pool at the same horizon apparently sets in to the west where the oil leaves off as exhibited by the economic geology map accompanying this report. In Grant, the record of one of these marginal gas wells near the head of Long run; viz., Patrick Shaughnessy No. 1 (131), is published on page 289 of Vol. I(A) of the State Survey reports. The record shows the gas pay in the top of the Gordon sand at a depth of 2721 feet, 2076 feet below the top of the Pittsburgh coal.

Prospective Oil and Gas Territory, Grant District.—Grant district has been quite thoroughly prospected in some portions of its area, yet there remains a large acreage that looks favorable for oil and gas both from the standpoint of structure and present development. Considering these areas from northwest to southeast: (1) that, lying along the axis of the Robinson syncline southwest from Canton to the Grant-West Union district line, looks good for both Big Injun and Gordon oil; (2) that, southeast from Canton to Poverty run, for gas; (3) that, covered by the drainage of Flint run from the mouth of Neds run southeast to the mouth of Howell run, looks good for Big Injun and Gordon gas; (4) that, northwest from the main channel of Morgans run to the dividing ridge, for gas at the same horizons; (5) that, on the east slope of the Arches Fork anticline southward from the main channel of Flint run to Long run, lying roughly between the 450 and 275-foot structure contours of the Pittsburgh coal as outlined on the map referred to above, for Gordon Stray and Gordon gas; (6) that, southward from well No. 136 near Numan to the Grant-Greenbrier district line between the 250 and 225-foot structure contours of the Pittsburgh coal as given on the map mentioned above, appears quite favorable for Gordon oil.

WEST UNION DISTRICT.

The rock strata of West Union district are much warped and disturbed, as the latter's area is traversed in a northeast-southwest direction by three structural folds; viz., the Big Moses and Arches Fork anticlines, and the Burchfield syncline. As revealed both by present development and structure, by far the greater portion of the district is favorable for natural gas; while only a small area along the axis of the Burchfield Basin appears favorable for oil. A discussion of the oil and gas development will now be given from northwest to southeast in the district.

The Big Moses anticline traverses the extreme northwest corner of West Union district and within the boundaries of the latter area just on the east side of the axis of this arch there occur some 8 or 10 gas wells in the Big Injun sand, as exhibited on the map accompanying this report by wells Nos. 139-144 inclusive, and others not listed. The summarized records of the following wells is this region are given in the table of wells for Doddridge county, page 290: W. W. Pratt No. 1 (140), Ed Cain No. 1 (143), and Jos. Freeman No. 1 (144). All were gassers in the Big Injun.

Frank Smith Oil Pool.—Passing southeastward to the axis of the Burchfield syncline, a small Big Injun sand oil pool is found on the waters of Piggin run, 1.5 miles due north of West Union. The pool consists of 8 to 10 wells on the Frank Smith farm, the brief logs of four of which are given under Nos. 147-150 inclusive, in the table of wells mentioned above, page 290. These wells were very light, and the records for same were very incomplete. The chances are quite favorable for the extension of this pool to the northeast along the axis of the Robinson Basin to Canton, in view of the 10-bbl. oil showing in the Big Injun sand in the Wm. Freeman No. 1 well (146), located on Nutter fork, one mile northwestward from Knight. Its extension to the southwest, however, appears to be shut off by the dry holes (151 and 152) on the land of Frank Scott and Maxwell Heirs, along the east bank of Middle Island creek. The latter (152) had a showing of oil and gas in the Big Injun.

The following records are from wells located ½ to 1 mile eastward from the Smith pool:

Vincent Cain No. 1 Well Record (153).

Located in West Union District, 2¼ miles north 15° east of West Union. Authority, J. E. Trainer. Rig commenced July 9, 1906.

(Elevation, 945' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	303	303
Native coal, (Lower Uniontown)	2	305
Unrecorded	259	564
Pittsburgh coal	4	568
Unrecorded	387	955
Sand, Little Dunkard (I Cow Run)	10	965
Unrecorded	114	1079
Big Dunkard sand	21	1100
Unrecorded	85	1185

	Thickness. Feet.	Total. Feet.
Sand, Salt? ("Gas")	65	1250
Slate and lime	40	1290
Salt sand (water, 1325') and unrecorded	553	1843
Big Lime, sandy and hard (show of oil and gas, 1952', steel line measurement; **Big Injun sand**, gas, 2018'8", increasing for 6') and unrecorded to bottom	869	2712

10" casing, 145'; 8¾" casing, 1089'; 6⅝" casing (steel line measurement), 1843'8".

Although the record fails to note it, a showing of oil in the Gordon sand was reported from this well by a farmer in that vicinity.

D. L. Dotson No. 1 Well Record (154).

Located in West Union District, 1¾ miles northeast of West Union. Authority, Eastern Oil Company. Completed Oct. 31, 1899.

(Elevation, 865' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1700	1700
Big Lime	100	1800
Keener sand	45	1845
Big Injun sand (2 screws of break, 1880'; big gas, 1890'), and unrecorded to bottom	53	1898

13" casing, 16'; 10" casing, 287'; 8" casing, 1002'; 6¼" casing, 1700'.

The northeastern portion of West Union district is traversed by the Arches Fork anticline which makes all that part southeast from Knight fine gas territory. About 30 gas wells have been drilled thereon. The three following records from wells in this region show the Big Injun, Gordon Stray and Gordon sands as the main gas horizons:

P. B. McClain No. 1 Well Record (155).

Located in West Union District, on Nutter fork, one mile southeast of Knight. Authority, Eastern Oil Company.

(Elevation, 1010' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded (water, 30')	465	465
Pittsburgh coal and unrecorded	1035	1500
Maxton sand and unrecorded	238	1738
Little lime and unrecorded	72	1810
Blue Monday sand and unrecorded	15	1825
Big Lime	50	1875
Big Injun sand (gas, 1915', 1985', and 2005')	140	2015
Unrecorded (gas in Gordon Stray sand, 2600')	593	2608
Gordon sand and unrecorded to bottom	22	2630

13" casing, 15'; 10" casing, 225'; 8¼" casing, 1015'; 6⅝" casing, 1825'.

Robert Harper No. 1 Well Record (157).

Located in West Union District on England's run, 1¼ miles northwest of Morgansville. Authority, Philadelphia Company. Completed June 25, 1910.

(Elevation, 950′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	690	690
Sand, Little Dunkard? (Moundsville)	25	715
Unrecorded	240	955
Sand, Big Dunkard? (Burning Springs)	20	975
Unrecorded	100	1075
Sand, Salt? (II Cow Run)	58	1133
Unrecorded	67	1400
Sand, Maxton? (Salt), (gas, 1475′)	85	1485
Unrecorded	217	1702
Big Lime (gas, 1703′)	76	1778
Big Injun sand, (gas, 1780′)	127	1905
Unrecorded	45	2050
Sand, Gantz? (Squaw)	40	2090
Unrecorded to bottom	655	2745

10″ casing, 176′; 8¼″ casing, 1133′; 6⅝″ casing, 1805′.

Pressure in 6⅝″ casing:

1st minute, 10 lbs. to the sq. in.
10th minute, 75 lbs. to the sq. in.
30th minute, 140 lbs. to the sq. in.

According to D. B. Reger, the above well starts 60 feet by hand-level above the Uniontown coal; hence, the Pittsburgh coal belongs at about 360 feet. The driller has evidently mistaken the Salt sand for the Maxton.

Lloyd Davis No. 1 Well Record (161).

Located in West Union District, one mile south of Smithton. Authority, Carter Oil Company. Well completed January 4, 1904.

(Elevation, 860′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	245	245
Little Pittsburgh coal?	1	246
Unrecorded	354	600
Cave	200	800
Sand, Cow Run? (Big Dunkard)	35	835
Unrecorded	145	980
Sand, Cow Run? ("Gas" and II Cow Run)	240	1220
Unrecorded	44	1264
Salt sand (little gas, 1270′)	40	1304
Unrecorded	206	1510
Cave	10	1520
Unrecorded	20	1540
Big Lime	62	1602
Big Injun sand (little gas, 1602′)	86	1688

	Thickness. Feet.	Total. Feet.
Unrecorded	582	2270
Gordon Stray sand (some gas, 2274')	6	2276
Unrecorded	25	2301
Gordon sand (fair gas, 2303')	4	2305
Unrecorded	176	2481
Shells and unrecorded to bottom	33	2514

10" casing, 300'; 8¼" casing, 980'; 6⅝" casing, 1538'; 4" tubing, 2317'.

The record is quite interesting in that four gas horizons occur; viz., Salt, Big Injun, Gordon Stray and Gordon sands. The Pittsburgh coal is thin and unimportant.

Two miles northward on the flattened crest of the Arches Fork anticline, near the head of Jockeycamp run, there occur 3 or 4 light oil wells in what appears to be the Salt sand. The following record of a well drilled by the Eastern Oil Company shows the oil pay 405 feet above the top of the Big Lime near the top of the Salt sand. The well is also a gasser in the Big Injun:

J. B. Coulehan No. 1 Well Record (156).

Located in West Union District, 1¼ miles northeast of Smithton. Authority, Eastern Oil Company. Completed August 4, 1906.

(Elevation, 940' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	12	12
Sand, (Carroll)	28	40
Unrecorded	20	60
Coal, Uniontown	2	62
Unrecorded	92	154
Slate and shells	162	316
Coal, Mapletown? (Redstone)	2	318
Red rock	522	840
Sand, (Big Dunkard)	30	870
Unrecorded	25	895
Break	5	900
Sand	265	1165
Slate	40	1205
Salt sand (little gas, 1240'; gas and oil, 1250'; water, 1260')	370	1575
Red rock	45	1620
Little lime	7	1627
Pencil cave	8	1635
Blue Monday sand	20	1655
Big Lime	80	1735
Unrecorded	8	1743
Big Injun sand (gas, 1743') to bottom and not through sand	7	1750

13" casing, 10'; 10" casing, 154'; 8¼" casing, 890'; 6⅝" casing, 1640'.

Southwestward 3 miles, near the mouth of Bluestone creek near West Union, there occurs a small Gordon sand oil pool of 5 or 6 wells on a slight structural terrace along the western slope of the Arches Fork anticline. The wells are light, not making at the start over 15 to 20 barrels, daily:

L. T. Davis No. 1 Well Record (162).

Located in West Union District, ¼ mile southeast of West Union. Authority, Empire Oil Company. Completed in 1910.

(Elevation, 780' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	235	235
Coal, Sewickley? (Redstone)	5	240
Unrecorded	450	690
Sand, Little Dunkard	16	706
Unrecorded	74	780
Big Dunkard sand	64	844
Unrecorded	10	854
Sand, Gas? (Burning Springs)	12	866
Unrecorded	64	930
Sand, Salt? ("Gas")	50	980
Unrecorded	30	1010
Sand, Second Salt? (II Cow Run and Salt)	160	1170
Unrecorded	185	1355
Sand, Maxton? (Salt) (first gas)	35	1390
Unrecorded	190	1580
Pencil cave	7	1587
Big Lime	57	1644
Big Injun sand (some gas)	144	1788
Sand, Squaw? (Big Injun)	27	1815
Unrecorded	80	1895
Sand, Berea? (Squaw)	20	1915
Unrecorded	5	1920
Sand, Gantz? (Berea)	80	2000
Unrecorded	100	2100
Fifty-foot sand	50	2150
Unrecorded	100	2250
Thirty-foot sand	40	2290
Unrecorded	20	2310
Gordon Stray sand	19	2329
Unrecorded	1	2330
Gordon sand (oil)	12	2342
Unrecorded to bottom	6	2348

The well starts 5 to 15 feet below the Uniontown coal; hence, the coal at 235 feet appears to correlate with the Redstone bed for the reasons given below.

Gribble and Dufour No. 1 Well Record (163).

Located in West Union District, ½ mile southeast of West Union. Authority, Gribble and Dufour. Completed in 1907.

(Elevation, 786′ L-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	320	320
Coal, Pittsburgh? (Little Pittsburgh)	2	322
Unrecorded	573	895
Gas sand	65	960
Unrecorded	115	1075
First Salt sand	75	1150
Unrecorded	150	1300
Second Salt sand (gas)	80	1380
Unrecorded	95	1475
Maxton sand	35	1510
Unrecorded	30	1540
Little lime	20	1560
Unrecorded	15	1575
Big Lime	70	1645
Big Injun sand	85	1730
Unrecorded	608	2338
Gordon sand (oil)	8	2346
Unrecorded to bottom	16	2362

"Initial oil production from Gordon, 15 barrels daily; now (July 6, 1910,) making 3 barrels daily.

The well starts 20 feet below the Uniontown coal; hence, the coal at 320 feet appears to represent the Little Pittsburgh bed, since the Uniontown-Pittsburgh coal interval northward and at Long Run, is only 290 to 300 feet.

According to W. D. Gribble of West Union, other wells in this pool; viz., the Jap Stewart Heirs No. 1 well (164) was making (July 7, 1910), one barrel of oil daily from the Gordon, and is 5 years old; and the Jos. Cheuvront No. 1 (165) in addition to an oil show in the Gordon, produces one-third million cubic feet of gas daily from the Big Injun sand.

The southeast portion of West Union is situated over a structural dome of the Arches Fork anticline, making it specially favored gas territory. Several fine gas wells, mostly in the Salt and Big Injun sands, occur on or near the crest of this dome. The six following records are from wells in this region:

Lewis Maxwell No. 8 Well Record (166).

Located in West Union District, 1¾ miles south 10° east of West Union. Authority, Mountain State Carbon Black Company.

(Elevation, 900' B-A. T.)	Thickness. Feet.	Total. Feet.
Conductor	10	10
Unrecorded	260	270
Coal, Pittsburgh? and unrecorded (no Little Dunkard; Big Dunkard—Shell)	582	852
Sand, "Gas"? (Burning Springs)	83	935
Unrecorded	50	985
Sand, Salt? ("Gas")	40	1025
Unrecorded	33	1058
Sand, Salt? (II Cow Run)	12	1070
Unrecorded	400	1470
Maxton sand	12	1482
Unrecorded	53	1535
Little lime	10	1545
Pencil cave	11	1556
Blue Monday sand	81	1637
Big Lime	59	1696
Big Injun sand (gas, 1716'; 1770')	91	1787
Unrecorded	141	1928
Grit	107	2035
Unrecorded (no Fifty-foot or Thirty-foot sand)	327	2362
Gordon Stray sand	6	2368
Unrecorded	15	2383
Gordon sand	14	2397
Unrecorded to bottom	36	2433

10" casing, 165'; 8¼" casing, 855'; 6⅝" casing, 1642'.

Well starts 15 feet above Uniontown coal; hence, the coal at 270' may represent the Redstone bed.

Lewis Maxwell No. 1 Well Record (171).

Located in West Union District, on Left Fork of Arnolds creek, 3¼ miles south of West Union. Authority, Acme Carbon Company. Completed December 7, 1909.

(Elevation, 870' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	210	210
Pittsburgh coal	3	213
Unrecorded	520	733
Sand, Little Dunkard? (Big Dunkard)	17	750
Unrecorded	90	840
Sand, Big Dunkard? ("Gas")	60	900
Unrecorded	35	935
Sand, "Gas"? (II Cow Run)	60	995
Unrecorded (3 bailers of water at 1030')	270	1265
Salt sand	31	1296
Unrecorded	234	1530

	Thickness. Feet.	Total Feet.
Little lime	25	1555
Pencil cave	5	1560
Big Lime	80	1640
Big Injun sand (little gas, 1640')	30	1670
Unrecorded	200	1870
Sand, Gantz?	140	2010
Unrecorded	268	2278
Gordon Stray sand	2	2280
Unrecorded	20	2300
Gordon sand (gas show, 2300')	10	2310
Unrecorded to bottom	95	2405

Lewis Maxwell No. 2 Well Record (173).

Located in West Union District, 4¼ miles south 5° west of West Union. Authority, Acme Carbon Company. Completed April 16, 1910.

(Elevation, 905' B-A. T.)	Thickness. Feet.	Total. Feet.
Conductor	8	8
Unrecorded (water, 55', and 264')	482	500
Coal (Harlem)	4	504
Unrecorded	101	605
Coal (Bakerstown)	5	610
Unrecorded	102	712
Sand, Little Dunkard? (Big Dunkard) (1 bailer of oil per hour at 718')	66	778
Unrecorded	42	820
Sand, Big Dunkard? (Burning Springs)	25	845
Unrecorded	35	880
Gas sand	85	965
Unrecorded	60	1025
Sand, Salt? (II Cow Run) (1 bailer of oil, 1030'; 8 bailers water, 1078')	65	1090
Unrecorded	140	1230
Coal (one of the Pottsville)	6	1236
Unrecorded	72	1308
Salt sand (gas, 1323'; second gas, 1365') (0.4 mercury in 8¼" casing) and unrecorded to bottom	97	1405

10" casing, 275'; 8¼" casing, 848'.

The well starts about 75 feet below the Uniontown coal; hence, the Pittsburgh coal horizon belongs at about 220 feet in the well, making the beds at 500' and 605' correlate with the Harlem and Bakerstown coals, respectively, and the **oil horizon** at 718 feet in the top of the Big Dunkard sand, and not the Little Dunkard as given in the original log. In addition to oil, the well had an initial gas production in the Salt sand of 5,965,000 cubic feet daily as calculated from the test mentioned in the above log. Another well (172), drilled within

15 feet of the No. 173, just mentioned, is a fine gasser in the Big Injun sand.

Leeman Maxwell No. 4 Well Record (174).

Located in West Union District, on Bluestone creek, 4 miles due south of West Union. Authority, Carnegie Natural Gas Company.

(Elevation, 1005′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1268	1268
Salt sand (gas, 1273′)	28	1296
Unrecorded	44	1340
Salt sand (gas, 1344′) and unrecorded to bottom	16	1356

10″ casing, 169′; 8¼″ casing, 864′; 4″ casing, 590′; 3″ tubing, 760′.

Pressure test in pounds to the sq. inch:

1st ½ minute, 340 lbs.
1st minute, 340 lbs.
2nd minute, 370 lbs.
3rd minute, 380 lbs.
4th minute, 395 lbs.
5th minute, 400 lbs.
15th minute, 450 lbs.
Rock pressure, 610 lbs.

The well starts 40 feet below the Uniontown limestone, according to D. B. Reger; hence, the Pittsburgh coal horizon belongs at about 275 feet in the well.

Leeman Maxwell No. 6 Well Record (175).

Located in West Union District, 3½ miles south of West Union. Authority, Carnegie Natural Gas Company. Completed April 13, 1910.

	Thickness. Feet.	Total. Feet.
Unrecorded	1322	1322
Salt sand (gas, 1330′) to bottom	18	1340

10″ casing, 169′; 8¼″ casing, 864′; 4″ casing, 590′; 3″ tubing, 760′.

Pressure test in pounds to the square inch in 3″ tubing.

1st ½ minute, 185 lbs.
1st minute, 350 lbs.
3rd minute, 435 lbs.
4th minute, 440 lbs.
5th minute, 440 lbs.
Rock pressure, 480 lbs.

Along the southwest border of West Union district, there occur a number of Big Injun sand gassers along the steep western slopes of the Arches Fork anticline.

In addition to their summarized record as published in the table of wells for Doddridge county, page 290, the more detailed logs of the following list of wells located in this region, are published on the pages indicated of Volume I(A) of the State Survey reports:

Map No.	Name of Well.	Location.	Page of Vol. I(A).
169	Jacob Netzer No. 1....	2⅓ miles S. W. of West Union.	300
179	Harvey Smith No. 1...	4 miles S. of Central Station..	301
180	Harvey Smith No. 2...	½ mile S. W. of well No. 179..	301

Well No. 179 made some oil in Maxton and gas in Big Injun, but considered almost the same as a dry hole by the Company. In the two Smith wells (Nos. 179 and 180) a heavy flow of gas was struck in the Big Injun.

The four following records of other wells in this field give much valuable data as to the oil and gas horizons and coal beds:

Lewis Maxwell No. 1 Well Record (167).

Located in West Union District on Pritchard run, 2 miles southwest of West Union. Authority, Philadelphia Company.

(Elevation, 832′ L-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	167	167
Native coal (Uniontown)	3	170
Unrecorded	270	440
Coal, Pittsburgh? (Redstone)	5	445
Unrecorded	485	930
Sand, Little Dunkard (I Cow Run)	25	955
Unrecorded	25	980
Big Dunkard sand	15	995
Unrecorded	125	1120
Gas sand	75	1195
Unrecorded	35	1230
Sand, Salt? (II Cow Run)	82	1312
Unrecorded	218	1630
Maxton sand	20	1650
Unrecorded	75	1725
Little lime	20	1745
Pencil cave	12	1757
Big Lime	93	1850
Sand, Big Injun? (Keener) (gas, 1876′)	22	1872
Break	4	1876
Sand, Big Injun (oil, 1900′; gas, 1905′)	34	1910
Unrecorded	162	2072
Sand, Berea? (Squaw) (show of black oil, 2085′)	88	2160
Unrecorded	315	2475
Sand, Gordon? (Gordon Stray) shells with pebbles	20	2495
Unrecorded to bottom	558	3053

The well starts 50 feet below the Washington coal.

Lafayette Fleming No. 1 Well Record (176).

Located in West Union District on Right fork, 3¾ miles south 30° west of West Union. Authority, Carter Oil Company. Completed January 19, 1901.

(Elevation, 860′ L-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	600	600
Cave	225	825
Sand, Cow Run (I Cow Run) (oil, 837′)	75	900
Unrecorded	23	923
Sand, Salt? (Big Dunkard and Burning Springs) (water 940′)	100	1023
Unrecorded	535	1558
Maxton sand	57	1615
Unrecorded	5	1620
Big Lime (gas, 1632′)	80	1700
Big Injun sand (gas, 1710′)	66	1766
Unrecorded	535	2301
Stray sand	12	2313
Unrecorded	6	2319
Gordon sand (poor)	8	2327
Unrecorded to bottom	118	2445

10″ casing, 451′; 8¼″ casing, 850′; 6¼″ casing, 1621′.

J. Wesley Smith No. 1 Well Record (178).

Located in West Union District. 1¾ miles northeast of Nay. Authority, Carter Oil Company. Completed July 19, 1901.

(Elevation, 925′ L-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded (no Pittsburgh coal)	600	600
Cave	350	950
Unrecorded	50	1000
Sand, Cow Run? (Burning Springs)	25	1025
Unrecorded	200	1225
Sand, Salt. (II Cow Run and Salt)	100	1325
Unrecorded	215	1540
Maxton sand, hard	25	1565
Unrecorded	110	1675
Big Lime, hard (light gas, 1680′)	78	1753
Big Injun sand (fair gas, 1763′)	75	1828
Unrecorded to bottom	29	1857

Ed Smith No. 1934 Well Record (181).

Located in West Union District, 3¼ miles south of Central Station. Authority, Philadelphia Company. Completed Aug. 3, 1904.

(Elevation, 940′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	60	60
Coal, native (Waynesburg "A")	10	70
Unrecorded	480	550

	Thickness. Feet.	Total. Feet.
Pittsburgh coal	5	555
Unrecorded	245	800
Sand, Little Dunkard? (Grafton)	60	860
Unrecorded	150	1010
Big Dunkard sand	66	1076
Unrecorded	49	1125
Sand, Salt? (Burning Springs and "Gas")	200	1325
Unrecorded	99	1414
Salt sand	46	1460
Unrecorded	216	1676
Coal, (No. 2 Gas?)	7	1683
Unrecorded	85	1768
Maxton sand	70	1838
Unrecorded	12	1850
Big Lime (oil, 1850', 2 bbl.)	70	1920
Big Injun sand (gas, 1931' and 1950')	80	2000
Unrecorded	515	2515
Gordon sand	35	2550
Unrecorded	160	2710
Fifth sand	20	2730
Unrecorded to bottom	113	2843

The above is an interesting record in that a 2-barrel oil pay was encountered in the top of the Big Lime. The well is a good gasser in the Big Injun sand.

Prospective Oil and Gas Territory, West Union District.—West Union district has not been prospected to quite the extent that McClellan and Grant have undergone; hence, there yet remains a large acreage of territory that is favored by geologic structure, and has not yet been condemned by present development. Considering these areas northwest to southeast across the district; (1) that, along the crest of the Big Moses anticline northwest from Nutter fork to the Tyler-Doddridge county line, and south and west of Camp Mistake and Gorby runs, respectively, appears very favorable for Big Injun sand gas; (2) that, along the axis of the Burchfield syncline northeastward from the Frank Smith oil pool on Piggin run to West Union-Grant district line, for Big Injun sand oil; (3) that, immediately northwest of the intersection of the 80° 45' meridan and the 39°15' parellel of north latitude, for Salt, Big Injun, Gordon Stray and Gordon gas; (4) and that, in the extreme southern border of the district, included in the drainage basin of Left fork of Arnolds creek south of the fork of the private roads at the Maxwell wells (172 and 173), for gas.

CENTRAL DISTRICT.

Central district occupies the extreme western portion of Doddridge and it is bounded on the west by Ritchie county. Its entire area lies within the Burchfield Basin. The axis of this structural fold traverses the district in a northeast-southwest direction, and bisects it into two nearly equal parts. While the structure in a large measure favors the segregation of oil and gas at the several horizons into pools of commercial value, yet the developments thus far have been rather discouraging. Two small oil pools have been opened; viz., the Harris oil pool in the Big Injun sand near Orontes, and the Douglas oil pool in the Maxton sand, 1.2 miles north 75°-80° east of Joy. Recently some very heavy gassers in the Big Injun sand have been reported along the crest and slopes of the Big Moses anticline just across the county line in the extreme southern portion of Tyler; hence, it would appear that the northwestern border of Central district is favorably located for gas at the same horizon. The development from northwest to southwest and southeast will now be considered.

The following is the record of a well as published, with some modifications in parentheses, on page 524 of the Marshall-Wetzel-Tyler report of the State Geol. Survey:

Finley Dotson No. 1 Well Record (T 202).

Located in Central District, 1.1 mile northeast of Orontes.

(Elevation, 770' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	393	393
Coal, poor, Pittsburgh? (Redstone?)	1	394
Unrecorded	246	640
Cave	270	910
Sand, Cow Run? **(Big Dunkard)**	30	940
Unrecorded	195	1135
Sand, Salt? **(II Cow Run and Salt)**	130	1265
Unrecorded	75	1340
Salt sand (Oil show, 1446')	160	1500
Unrecorded	140	1640
Cave, bad (Pencil)	15	1655
Big Lime, poor	43	1698
Big Injun sand (gas show, 1698' and 1815')	117	1815
Unrecorded to bottom	69	1884

"Considered dry and abandoned."

The well starts 95 feet by hand-level below the Washington coal; hence, the bed at 393 feet may represent the Redstone coal.

One mile northeastward, the W. C. Griffith No. 1 well (182) was a light gasser in the Big Injun sand.

Southwestward on Long run the Carter Oil Company opened a small Big Injun sand oil pool on the Harris farm near Orontes in 1902. It is located on a structural terrace on the eastern slope of the Big Moses anticline. The following is the record of the first well. It starts 10 feet below the Washington coal:

Carter-Harris No. 1 Well Record (192).

Located in Central District, ½ mile southwest of Orontes. Authority, Carter Oil Company. Drilled in 1902.

(Elevation, 825′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	675	675
Cave, bad	305	980
Sand, poor, Cow Run (I Cow Run)	15	995
Unrecorded	215	1210
Sand, Salt? ("Gas" and II Cow Run) (water, 1260′)	125	1335
Unrecorded	190	1525
Salt sand	45	1570
Unrecorded	125	1695
Cave	30	1725
Big Lime	50	1775
Big Injun sand (oil, 1783-1789′)	25	1800
Unrecorded to bottom	14	1814

The well started off with a production of over 200 barrels daily from the Big Injun sand, but fell off very rapidly. Out of seven other wells drilled immediately surrounding this well, only two produced oil in paying quantities; viz., the Williamson Heirs No. (191) and B. C. Powell No. 1 (194).

The record of well No. 191 is given partially in the table of wells for Doddridge county, and in detail on page 302 of Vol. I(A) of the State Survey. The following is the record of another well in this pool.

Daniel H. Harris No. 3 Well Record (193).

Located in Central District, 0.6 mile southwest of Orontes. Authority, Carter Oil Company. Completed Aug. 15, 1902.

(Elevation, 835' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1785	1785
Big Injun sand (oil, 1794'-1796'; gas, 1792'-1794')	105	1890
Unrecorded to bottom	5	1895

This well proved a fair gasser in the Big Injun sand. The summarized records of wells Nos. 194 and 195 located nearby are given in the table of wells for Doddridge county, page 290.

The following is the record of a gas well located one-half mile northwest of the Harris oil pool on Hugle run:

John Harris No. 1 Well Record (190).

Located in Central District, 2¼ miles north 75° west of Central Station. Authority, Carter Oil Company. Completed in 1902 or 1903.

(Elevation, 835' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded (no **Pittsburgh coal**)	716	716
Cave	274	990
Sand, Cow Run (I Cow Run)	15	1005
Unrecorded	225	1230
Sand, Salt? (II Cow Run) (water, 1245')	65	1295
Unrecorded	105	1400
Salt sand	47	1447
Unrecorded	68	1515
Sand, Maxton? (Salt)	25	1540
Unrecorded	187	1727
Big Lime	51	1778
Big Injun sand (gas, 1778'-1786')	93	1871
Unrecorded to bottom	39	1910

"Fair gas well in Big Injun."

Southeastward along the Burchfield Basin there have been drilled several practically dry holes. The following records give interesting data for this region

John Chisler No. 1 Well Record (186).

Located in Central District, ¾ mile southwest of Central Station. Authority, Carter Oil Company.

(Elevation, 900′ B. A-T.)	Thickness. Feet.	Total. Feet.
Unrecorded	780	780
Cave	280	1060
Sand, Cow Run (I Cow Run)	20	1080
Unrecorded	234	1314
Sand, Salt? ("Gas" and II Cow Run)	145	1459
Unrecorded	196	1645
Sand, Maxton? (Salt)	38	1683
Unrecorded	169	1852
Big Lime	64	1916
Big Injun sand (oil and gas show, 1975′)	59	1975
Unrecorded	260	2235
Berea Grit	45	2280
Unrecorded	345	2625
Gordon sand (shells) and unrecorded to bottom	460	3085

"Dry hole."

W. A. Duckworth No. 1 Well Record (188).

Located in Central District, 1¼ miles southwest of Central Station. Authority, Carter Oil Company. Completed February 10, 1904.

(Elevation, 865′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	80	80
Coal, Washington	2	82
Unrecorded	489	571
Coal, (Redstone?)	1	572
Unrecorded	153	725
Cave	385	1110
Sand, Cow Run? (Big Dunkard)	30	1140
Unrecorded	60	1200
Sand, Salt? ("Gas" and II Cow Run)	272	1472
Unrecorded	132	1604
Sand, Maxton? (Salt)	70	1674
Unrecorded	174	1848
Cave	17	1865
Big Lime (gas show, 1914′)	51	1916
Big Injun sand (oil show, 1994′)	78	1994
Unrecorded to bottom	87	2081

10″ casing, 474′; 8¼″ casing, 1110′; 6⅝″ casing, 1865′.

Frank Cooper No. 1 Well Record (189).

Located in Central District, ½ mile northeast of Duckworth Station. Authority, Carter Oil Company.

(Elevation, 980′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	180	180
Cave	1	181
Unrecorded	467	648
Coal, (Redstone?)	1	649
Unrecorded	126	775
Cave	75	850
Sand, Cow Run? (Murphy)	30	880
Cave	20	900
Sand, Cow Run? (Grafton)	25	925
Unrecorded	348	1273
Sand, Salt? ("Gas")	50	1323
Unrecorded	108	1431
Salt sand	215	1646
Unrecorded	174	1820
Maxton sand	40	1860
Unrecorded	41	1901
Cave	2	1903
Big Lime	68	1971
Big Injun sand (oil show, 2036′)	55	2026
Unrecorded to bottom	110	2136

10″ casing, 587′; 8¼″ casing, 1130′; 6⅝″ casing, 1876′.
"Show of dark oil in Big Injun. Never saved."

Wycliff Bee No. 1 Well Record (201).

Located in Central District, 1¼ miles southeast of Duckworth Station. Authority, Carter Oil Company. Completed January 15, 1903.

(Elevation, 945′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	690	690
Pittsburgh Coal	1	691
Unrecorded	1337	2028
Big Injun sand	89	2117
Unrecorded to bottom	30	2147

The above well is located near the axis of the Burchfield syncline. The latter resembles a rude canoe in Central district, with its upturned northeast end at Central Station, and southwest end at the Doddridge-Ritchie county line. One-half mile southeastward from the above well, the Carter Oil Company drilled another dry hole (202) on the L. D. Stuck farm, the detailed log of which is published on page 303 of Vol. I.(A) of the State Survey reports, and a brief record in the table of wells for Doddridge county, page 290.

This well starts 5 feet below the Washington "A" coal.

Southwestward 1.5 miles, there occurs a small oil pool in the Maxton sand. The following well record and data exhibit the horizon at which the oil is encountered:

S. H. Douglas No. 1 Well Record (204).

Located in Central District, 2 miles north of Nay. Authority, Carter Oil Company.

(Elevation, 900' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1760	1760
Maxton sand (oil, 1772'-1777')	20	1780
Unrecorded to bottom	14	1794

The well starts almost flush with the Washington "A" coal, or 130 feet above the Washington coal horizon (See Greenwood section, page 80, for interval); hence, the Pittsburgh coal horizon belongs at about 650 feet in the well. The oil horizon then evidently correlates with the Maxton sand.

The extreme southeast point of Central district reaches far enough up on the west slope of the Arches Fork anticline to catch the Big Injun sand gas pool of West Union district. The following is the record of a gas well at this horizon near the district line:

Jack Cunningham No. 1933 Well Record (205)

Located in Central District, 2 miles north of Nay. Authority, Philadelphia Company. Completed Oct. 9, 1905.

(Elevation, 1060' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	390	390
Coal, native (Uniontown)	3	393
Unrecorded	269	662
Coal, Pittsburgh? (Redstone?)	3	665
Unrecorded	385	1050
Sand, Little Dunkard (I Cow Run)	40	1090
Unrecorded	70	1160
Big Dunkard sand	30	1190
Unrecorded	55	1245
Gas sand	40	1285
Unrecorded	142	1427
Sand, Salt? (II Cow Run)	25	1452
Unrecorded	458	1910
Maxton sand	30	1940

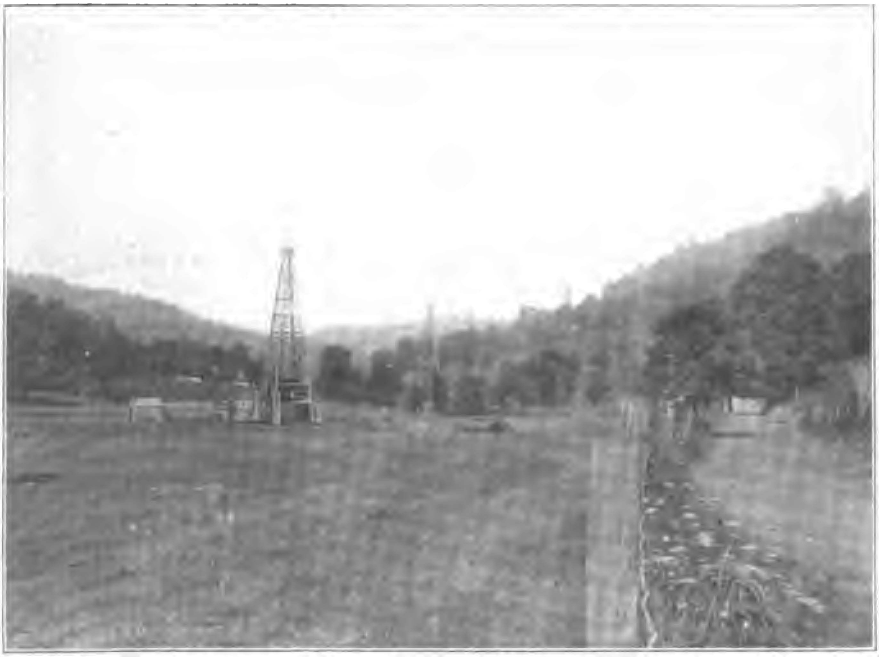


PLATE X (a).—Greenbrier Oil Field and Topography of the Dunkard series.

PLATE X (b).—Same as above.

	Thickness. Feet.	Total Feet.
Unrecorded (gas, 1958')	40	1980
Big Lime	5	1985
Big Injun sand (gas, 1986')	63	2048
Unrecorded to bottom	2	2050

10" casing, 595'; 8¼" casing, 1160'; 6⅝" casing, 1690'.

Pressure to the square inch in 6⅝" casing:

1st minute, 80 lbs.	15th minute, 330 lbs.
5th minute, 210 lbs.	30th minute, 370 lbs.

Westward down Cabin run a dry hole (206) was drilled by the Carter Oil Company on the Nancy Smith farm; and another, one-fifth mile southeast from Joy on the F. A. Leach farm (207). The latter is located nearly on the axis of the Burchfield Basin.

Two miles northwestward, near the Doddridge-Ritchie county line, a well (198) was drilled about 20 years ago by Murphy & Jennings on the Wm. Flanagan farm, the detailed record of which is used in connection with the section for Greenwood, page 80. A fair show of oil and gas was encountered in the Maxton sand in this well, and some gas in the Big Injun and Gantz sands.

Prospective Oil and Gas Territory, Central District.—As will readily be observed from the foregoing pages, the search for oil and gas in Central district has not thus far been very successful, yet there is included within its boundaries quite a large acreage that has not been condemned by dry holes, and which is favored by geologic structure. Considering these areas from north to south across the district; (1) that, in the extreme northern point of its area along the axis of the Big Moses anticline appears favorable for Big Injun sand gas, in view of other wells at this horizon both to the northeast and southwest; (2) that portion of the district from Tollgate eastward to the 325-foot structure contour of the Pittsburgh coal bed as outlined on the economic geology map accompanying this report, appears good for Big Injun gas, located, as this territory is, so near the crest of the Big Moses arch and to the southwest of a fair Big Injun gas well on the John Harris (190) farm on Hugle run; and (3) that, drained by Arnold creek northwest from Central Station to the gas well (183) on the W. Harrison Piggott farm, 0.3 mile north of the mouth of Licks run, appears favorable for Big Injun sand gas.

SOUTHWEST DISTRICT.

Southwest district occupies the southwest portion of Doddridge county. Its area is traversed in an almost north and south direction by the great Arches Fork anticline. A glance at the structure contour map of the Pittsburgh coal bed in this portion of the county, will show that much relief prevails therein. Here the latter coal varies from 275 feet above tide in the extreme western point of the district to 700 feet above the same datum in the northeastern corner of its area. The central and northwest portions have not been thoroughly tested, but sufficient drilling has been done to show that the Big Injun sand gas pool of West Union district reaches at least partly across Southwest district. On the extreme eastern border of the latter area there are about 75 oil wells in the **Gordon sand** in what is known as the **Stout oil pool.** As mentioned at the beginning of this chapter the latter pool was opened by the Carter Oil Company, February 1, 1899. This Company also opened another small oil pool on the W. B. Maxwell farm, 2 miles northwest from Kelly, at the same horizon.

The development of the oil and gas fields will now be considered from northwest to southeast across the district.

Attempts have been made to extend the Big Injun sand gas pool on the head of Right fork of Arnold creek to the southwest without much success. The following is the record of a well in this region:

D. M. Haught No. 1 Well Record (209).

Located in Southwest District, 2¼ miles northeast of Oxford. Authority, Philadelphia Company.

(Elevation, 940' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	230	230
Coal, (Lower Uniontown)	1½	231½
Unrecorded (no Pittsburgh coal)	703½	935
Sand, First Cow Run	35	970

	Thickness. Feet.	Total. Feet.
Sand, Second Cow Run? (Big Dunkard)	85	1055
Unrecorded	120	1175
Sand, Salt? ("Gas")	25	1200
Unrecorded	410	1610
Salt sand	66	1676
Unrecorded	109	1785
Blue Monday sand	15	1800
Big Lime	25	1825
Keener sand (little gas)	15	1840
Big Injun sand	50	1890
Unrecorded	164	2054
Sand, Berea? (Squaw)	134	2188
Unrecorded to bottom	690	2878

The well starts about 60 feet below the Washington coal; hence, the Pittsburgh coal horizon belongs at about 460 feet. The Gordon group of sands is not represented in this region, as will appear in the log of the W. L. Stinespring No. 1 well (209), published on page 304 of Vol. I(A) of the State Survey Reports, located one mile southwest of the Haught well (209).

The following is the log of an old well located at Oxford. The record is as published in Vol. I (exhausted) of the State Reports, with some modifications in parentheses by the writer. The well starts 45 feet below the Washington coal:

C. P. Broadwater No. 1 Well Record (211).

Located at Oxford, Southwest District. Authority, Carter Oil Company.

(Elevation, 810′ L-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded (water, 230′, 250′, and 525′)	700	700
Sand, (Murphy)	15	715
Limestone	30	745
Sand, very hard (Grafton)	5	750
Sandy shale and slate	40	790
Red shale (cave at 810′) (Pittsburgh)	50	840
Blue sandy shale	35	875
Blue sand and shale (I Cow Run)	52	927
Coal, (Brush Creek)	3	930
Dark shale	35	965
Sand, Dunkard, (Big Dunkard) (oil show)	50	1015
Dark shale and limestone	45	1060
Sand, hard (Burning Springs)	10	1070
Dark shale, black slate and limestone	90	1160
Blue sandy shale and sand in streaks	103	1263
Slate, black	10	1273

			Thickness. Feet.	Total. Feet.
Coal Kittanning? (Clarion)			4	1277
Slate, black			15	1292
Sand, (II Cow Run)	55′	Salt?	272	1564
Coal, (Tionesta)	3			
Slate, black	43			
Sand, (I Salt)	53			
Slate, black	10			
Coal, (Quakertown)	3			
Slate, black	11			
Sand white (II Salt)	35			
Sand, dark, (II Salt)	40			
Dark shale and sand	19			
Big Lime? Mountain?			18	1582
Dark Lime, shale and hard shell			82	1664
Sand, Big Injun? (Maxton)			24	1688
Unrecorded			342	2030
Sand, Berea? Gantz? and Fifty-foot? (Squaw)			72	2102
Unrecorded to bottom			4	2106

"Made less than one barrel a day after shooting in the Big Injun."

The Pittsburgh coal horizon belongs at 480 feet in the well; hence, the oil pay occurs in the **Maxton sand** and not the Big Injun. The Pittsburgh coal-Big Injun sand interval is 1361 feet in the W. L. Stinespring No. 1 well (210), located one mile northeast from Oxford.

The two following records are from comparatively dry holes on Sugar run southeast of Oxford:

David W. Gray No. 2 Well Record (213).

Located in Southwest District, ½ mile southeast of Oxford. Authority, Carter Oil Co. Completed, July 16, 1900.

(Elevation, 840′, B. A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	470	470
Pittsburgh coal	4	474
Unrecorded	166	640
Sand, Cow Run? (Murphy)	60	700
Unrecorded	260	960
Sand, Cow Run? (Big Dunkard)	40	1000
Unrecorded	675	1675
Maxton sand	30	1705
Unrecorded	30	1735
Big Lime	50	1785
Unrecorded	30	1815
Big Injun sand (gas, 1830′)	40	1855
Unrecorded	205	2060
Sand, Berea? (Squaw)	30	2090
Unrecorded to bottom	31	2121

David W. Gray No. 1 Well Record (214).

Located in Southwest District, 1 mile southeast of Oxford. Authority, Carter Oil Company. Completed April 24, 1899.

(Elevation, 860′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	480	480
Coal, Pittsburgh? (Little Pittsburgh), small show	0	480
Unrecorded	1160	1640
Big Lime	78	1718
Big Injun sand, poor	4	1722
Unrecorded to bottom	33	1755

The well starts about 115 feet below the Washington coal bed; hence, the Pittsburgh coal horizon belongs at about 425 feet in the well. Thus it appears quite probable that the well did not quite reach the main Big Injun sand, and for that reason is hardly a test for the head of Sugar run.

The following is the record of a gas well located 1.3 miles northeastward on South fork, nearly on the strike of the strata from the Gray No. 1 well (214). The well starts 130 to 140 feet below the Washington coal; hence, the Pittsburgh coal belongs at about 400 feet in the well:

Granville S. Nutter No. 1932 Well Record (212).

Located in Southwest District, 1¼ miles northeast of Oxford Authority, Philadelphia Company.

(Elevation, 830′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded (No Pittsburgh coal)	870	870
Sand, Big Dunkard? (I Cow Run)	40	910
Unrecorded	96	1006
Sand, "Gas"? (Burning Springs)	60	1066
Sand, Salt? ("Gas")	50	1116
Unrecorded	484	1600
Maxton sand	40	1640
Unrecorded	50	1690
Big Lime	55	1745
Big Injun sand (gas, 1750′)	90	1835
Unrecorded	590	2425
Gordon sand	75	2500
Unrecorded	140	2640
Fifth sand	20	2660
Unrecorded to bottom	78	2738

The following is the record of a Big Injun gas well near the crest of the Arches Fork anticline on Sheep run. The depth and thickness of the coal mentioned therein, as well as the depths to the Big Injun and Gordon sands were copied from the log as furnished Mr. Nutter by a driller on the well. The balance of the record was obtained from the Carter Oil Company:

Eli Nutter No. 1 Well Record (215).

Located in Southwest District, 1½ miles east of Nay. Authority, Carter Oil Company and Eli Nutter. Completed February 27, 1903.

(Elevation, 930' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	150	150
Coal, (Sewickley?)	12	162
Unrecorded	1463	1625
Big Lime	53	1678
Big Injun sand	30	1708
Unrecorded	207	1915
Berea Grit? (Squaw)	10	1925
Unrecorded	390	2315
Gordon sand and unrecorded to bottom	87	2402

The record fails to note the horizon at which the gas was encountered.

Three-fourths mile due southward, the same company drilled a well on the W. B. Maxwell farm, in which a showing of oil was encountered in what appears to be the Gas sand. Gas was also struck in both the Big Injun and Gordon sands. The Pittsburgh coal horizon should come at about 260 feet in this well, the log of which is as follows:

W. Brent Maxwell No. 6 Well Record (216).

Located in Southwest District, 2½ miles due east of Oxford. Authority, Carter Oil Company. Completed Aug. 10, 1900.

(Elevation, 895' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1000	1000
Sand, Cow Run? (Gas sand) (oil show, 1010')	10	1010
Unrecorded	175	1185
Salt sand (water, 1235')	245	1430
Unrecorded	170	1600
Big Lime	70	1670
Big Injun sand (gas, 1760')	80	1750
Unrecorded	580	2330
Gordon sand (gas, 2330')	4	2334
Unrecorded to bottom	217	2551

Southwestward 2.5 miles, the Carter Oil Company drilled a light gasser in the Big Lime, near the Doddridge-Ritchie county line. The well starts 120 feet below the Washington coal bed; hence, the Pittsburgh coal horizon should come at a depth of about 425 feet in the well, the record of which is as follows:

M. H. Wilson No. 1 Well Record (217).

Located in Southwest District, 1¼ miles northwest of Summers. Authority, Carter Oil Company. Completed March 25, 1902.

(Elevation, 935' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	496	496
Coal, Pittsburgh? (Little Clarksburg)	3	499
Unrecorded	241	740
Cave	205	945
Unrecorded	95	1040
Sand, Cow Run? (Gas sand)	80	1120
Unrecorded	30	1150
Sand, Salt? (Clarion)	20	1170
Unrecorded	184	1354
Salt sand	121	1475
Unrecorded	183	1658
Maxton sand	25	1683
Unrecorded	25	1708
Big Lime (light gas)	42	1750
Unrecorded	83	1833
Big Injun sand	33	1866
Unrecorded	184	2050
Sand, Berea? (Squaw)	35	2085
Unrecorded to bottom	31	2116

Passing about two miles eastward, there occur two Big Injun sand gassers on Upper and Camp runs, slightly east of the crest of the Arches Fork anticline. The complete record of one of these wells; viz., E. M. Gaston No. 1 (218), is published on page 300 of Vol. I(A) of the State Survey reports. The record of the other is as follows:

S. M. Gaston No. 1 Well Record (219).

Located in Southwest District, 2 miles northwest of Grove. Authority, Carter Oil Company. Completed July 1, 1902.

(Elevation, 920' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1625	1625
Big Lime	75	1700
Big Injun sand (gas, 1700')	50	1750
Unrecorded	150	1900
Sand, Gantz? (Squaw)	100	2000
Unrecorded	290	2290
Gordon Stray sand (oil show)	15	2305
Unrecorded to bottom	80	2385

The well starts 15 feet below the Uniontown coal, cropping in the road a short distance northeast of the boring.

About 2.5 miles northward there occurs a small oil pool in the Gordon sand on Big run over a structural terrace near the crest of the anticline. The three following records are from wells in this pool:

W. B. Maxwell No. 8 Well Record (220).

Located in Southwest District, 2 miles northwest of Kelly. Authority, Carter Oil Company. Completed Dec. 2, 1900.

(Elevation, 910' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	758	758
Sand, Cow Run? (Big Dunkard) (oil show, 808')	58	816
Unrecorded	359	1275
Salt sand (water, 110' in)	115	1390
Unrecorded	66	1456
Maxton sand (good gas, 1476')	29	1485
Unrecorded	92	1577
Big Lime	73	1650
Big Injun sand	80	1730
Unrecorded	340	2070
Sand, Berea? (Gantz)	9	2079
Unrecorded	180	2259
Gordon Stray sand	9	2268
Unrecorded	5	2273
Gordon sand (oil, 2274')	6	2279
Unrecorded to bottom	21	2300

The well starts 40 to 50 feet below the base of the Uniontown limestone; hence, the Pittsburgh coal horizon belongs at about 230 to 240 feet. Thus the oil show at 808 feet occurs in the Big Dunkard and not in either of the Cow Run sands. In addition to Gordon oil, a good flow of gas is reported in the Maxton sand.

W. B. Maxwell No. 2 Well Record (221).

Located in Southwest District, 1¾ miles northwest of Kelly. Authority, Carter Oil Company. Completed April 4, 1900.

(Elevation, 920' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1530	1530
Big Lime	75	1605
Big Injun sand (gas, 1611')	60	1665
Unrecorded	615	2280
Gordon sand (oil)	6	2286
Unrecorded to bottom	18	2304

W. B. Maxwell No. 4 Well Record (222).

Located in Southwest District, 1¾ miles northwest of Kelly. Authority, Carter Oil Company. Completed April 4, 1900.

(Elevation, 940′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1550	1550
Big Lime	90	1640
Big Injun sand (gas, 1720′)	80	1720
Unrecorded	564	2284
Gordon sand (oil, 2290′)	8	2292
Unrecorded to bottom	20	2312

This well starts 20 feet below the Uniontown limestone, cropping in the point northeast of the well; hence, the Pittsburgh coal horizon belongs at about 270 feet in the well. According to information furnished Mr. Reger, sufficient gas was obtained to run the boiler that provided steam for the well.

Stout Oil Field.—What is known as the Stout oil field of Doddridge county is that developed oil pool in the Gordon sand which extends from the head of Righthand fork of Lick run, 3 miles northwest of New Milton, almost due southward 8 miles to near Leopold. As mentioned at the beginning of this chapter, this pool was first opened by the Carter Oil Company on the S. W. Stout farm in February, 1899. The field is exceptional from a structure standpoint. The Gordon sand contains no water in this region, yet by far the greater portion of the pool occurs on the steep structural slope of the eastern flank of the Arches Fork anticline. The lenticular nature of the Gordon sand in this locality no doubt in a large measure prevents the oil from passing down along this horizon into the deep Robinson Basin on the southeast as it does along the southeast border of McClellan and Grant districts, and the eastern border of Greenbrier. The following table is made up from a series of wells arranged from north to south entirely across the length of the pool, and exhibits not only the **elevation below tide** of the top of the Gordon sand, but its depth and thickness as well. The elevation of the top of the hole is expressed in feet **above tide.** The table shows a total fall in the Gordon sand along this oil pool from north to south of over 250 feet. Of course, it may happen that along the eastern margin of the pool, the sand, instead of thinning away, has become close-grained and hard and in this way confined the oil to the high structural level it occupies. The table shows that the Gordon varies in thickness from 1 to 8 feet:

Table Showing Gordon Sand Data.—Stout Oil Field.

Map No.	NAME OF WELL	Elevation of Well A. T.	GORDON SAND		
			Depth	Elevation Below Tide	Thickness
			Feet.	Feet.	Feet.
258	Porter Maxwell No. 34	965B	2393	1428	4
259	Porter Maxwell No. 31	925B	2367	1442	3
260	Mary E. Gabbert No. 1	1070B	2452	1382	8
261	Wm. Stout No. 8	1265B	2673	1408	5
262	J. B. Maxwell No. 2	1055B	2531	1476	3
223	W. M. Stout No. 10	980B	2397	1417	5
265	L. W. Pearcy Heirs No. 1	985B	2568	1583	8
225	S. W. Stout No. 2	930B	2443	1513	5
226	S. W. Stout No. 4	935B	2421	1486	4
227	S. W. Stout No. 1	935B	2443	1508	5
228	S. W. Stout No. 19	990B	2506	1516	8
229	S. W. Stout No. 18	990B	2572	1582	5
266	John Gribble No. 3	1135B	2796	1661	5
267	John Gribble No. 2	1100B	2655	1555B	1
234	James H. Bode No. 1	1075B	2653	1578	5
235	James H. Bode No. 8	1075B	2675	1600	5
237	John A. Bode No. 1	990B	2597	1607	5
236	John A. Bode No. 2	1125B	2754	1629	7
268	Fred Fisher No. 3	1165B	2727	1562	4
238	Wm. H. Bode No. 1	930B	2569	1639	5
240	W. M. Williams No. 1	900L	2564	1664	6
241	John Wanstreet No. 1	855B	2539	1684	8
239	Andrew (J.) Hurst No. 1	930B			

The extreme eastern border of Southwest district holds within its boundaries a large portion of the Stout oil field. The five following records of wells in this pool, arranged from north to south across the district, give interesting data as to the oil and gas sands and the apparent absence of commercial coal beds:

W. M. Stout No. 10 Well Record (223).

Located in Southwest District, 0.8 mile northeast of Kelly. Authority, Carter Oil Company. Completed June 18, 1901.

(Elevation, 980′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1672	1672
Big Lime	54	1726
Unrecorded	10	1736
Big Injun sand	160	1896
Unrecorded	259	2155
Berea sand	11	2166
Unrecorded	208	2374
Gordon Stray sand	15	2389
Unrecorded	8	2397
Gordon sand (oil)	5	2402
Unrecorded to bottom	20	2422

10″ casing, 350′; 8¼″ casing, 960′; 6⅝″ casing, 1707′.

S. W. Stout* No. 1 Well Record (227).

Located in Southwest District, 0.6 mile southeast of Kelly. Authority, Carter Oil Company. Completed Feb. 1, 1899.

(Elevation, 935′ B-A. T.)	Thickness. Feet.	Total. Feet
Unrecorded	965	965
Sand, (Burning Springs)	65	1030
Unrecorded	190	1220
Sand, (Salt, in part)	280	1500
Unrecorded	80	1580
Sand, (Maxton, Cairo)	20	1600
Unrecorded	80	1680
Big Lime	25	1705
Sand 95′ Slate 5 Sand 55 Big Injun sand	155	1860
Unrecorded	583	2443
Gordon sand, all pay (oil)	5	2448
Unrecorded to bottom	36	2484

"Initial production, 50 bbls. of oil daily from Gordon."

The above is the first well drilled in the field. The Pittsburgh coal horizon belongs at about 415 feet in depth in the well. The latter coal appears to be absent in all the records obtained from this field.

---

*Vol. I, W. Va. Geol. Survey, page 322; 1899.

S. W. Stout No. 19 Well Record (228).

Located in Southwest District, 0.8 mile southwest of Kelly. Authority, Carter Oil Company.

(Elevation, 990' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1765	1765
Big Lime	85	1850
Big Injun sand	100	1950
Unrecorded	530	2480
Stray sand	20	2500
Unrecorded	6	2506
Gordon sand (oil, 2507'-2512')	8	2514
Unrecorded to bottom	16	2530

S. W. Stout No. 18 Well Record (229).

Located in Southwest District, 1¼ miles southeast of Kelly. Authority, Carter Oil Company.

(Elevation, 990' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1870	1870
Big Lime	100	1970
Big Injun sand (gas, 1995')	55	2025
Unrecorded	525	2550
Stray sand	10	2560
Unrecorded	12	2572
Gordon sand (oil)	5	2577
Unrecorded to bottom	20	2597

The initial production of the wells in the Stout field ranges from 5 to 100 barrels daily.

Prospective Oil & Gas Territory, Southwest District.—As mentioned on a preceding page, there yet remains a large acreage in Southwest district that has not been condemned by dry holes that appears to be favored by both geologic structure and present development. That portion of the district immediately southwest from the head of Right fork of Arnold creek, lying to the east of the 450-foot structure contour of the Pittsburgh coal bed as outlined on the economic geology map accompanying this report, seems very favorable for Big Injun gas; and that, near the crest and along both sides of the axis of the Arches Fork anticline from the West Union-Southwest district line, southward to the Doddridge-Ritchie county line, certainly is favored by structure for gas territory.

COVE DISTRICT.

Cove district is situated in the southern point of Doddridge county, and is joined on the south by Gilmer and Lewis counties. Its entire area lies within the Robinson synclinal basin, the axis of which intersects the New Milton-Cove district line on the head of Town Camp run, 2.4 miles northeast from Leopold, bears southwestward, and crosses the Doddridge-Gilmer county line 0.9 mile east of Spurgeon. After entering Cove from the northeast, the axis of the fold rises rapidly in elevation southwestward, elevating the Pittsburgh coal horizon from 275′ A.T. to over 400′ A.T. at the southern margin of the district.

The Southern end of the Stout oil field, located on the western slope of this structural basin, is included within the boundaries of Cove district. The latter area also catches a small portion of the Fink oil field in the Berea sand on the eastern slope of the same basin. The development within the district will now be discussed from northwest to southeast.

The Stout oil field enters the area on the head of Cove creek and follows this stream southward to the axis of the Robinson Basin. There are 35 to 40 oil wells in this Gordon sand field included within the district. In addition to the summarized records of the following wells from the Cove district portion of the Stout field as listed in the table of wells for Doddridge county, page 290, their more complete logs are published on the pages indicated of Vol. I(A) of the State Geological Reports:

Map No.	Name of Well.	Location.	Page of Vol. I(A)
233	L. G. Chapman No. 1......	0.6 mile N of Grove.....	297
234	Jas. H. Bode No. 1.........	1.5 mile N 30° E of Grove	298
235	Jas. H. Bode No. 8.........	1.3 mile N E of Grove..	299
236	John A. Bode No. 2.........	1.5 mile N E of Grove..	300
237	John A. Bode No. 1.........	1.2 mile N E of Grove..	299
238	Wm. H. Bode No 1.........	1.0 mile N 80° E of Grove	299
241	John Wanstreet No. 1.....	0.6 mile N 15° W of Leopold	297

The L. G. Chapman well (233) was dry in the Gordon sand, but a gasser in the Big Injun.

The following well record is here republished from page 297 of Vol. I(A) mentioned above, in order to show the relation of the oil sand—Gantz? (Berea)—of the Fink field, to the oil sand—Gordon—of the Stout field, the Squaw, and the Big Injun sands. The Fink field is located only 4 miles southeast from this well (240). The well mouth is 35 feet below the Washington coal bed; hence, the Pittsburgh coal horizon belongs at about 520 feet in depth:

W. M. Williams No. 1 Well Record (240).

Located in Cove District, 1⅛ miles north 15° west of Leopold. Authority, Carter Oil Company.

(Elevation, 900′ L-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded (no Pittsburgh coal)	700	700
Cave	300	1000
Unrecorded	15	1015
Sand, Cow Run? (Big Dunkard)	45	1060
Unrecorded	250	1310
Sand, Salt? (II Cow Run)	83	1393
Unrecorded	337	1730
Maxton sand (water, 1738′)	20	1750
Unrecorded	80	1830
Big Lime	110	1940
Big Injun sand (gas, 1940′; water, 1960′)	92	2032
Unrecorded	133	2165
Squaw sand	20	2185
Unrecorded	165	2350
Sand, Gantz? (Berea)	12	2362
Unrecorded	182	2544
Gordon Stray sand	8	2552
Unrecorded	12	2564
Gordon sand (oil, 2564′)	6	2570
Unrecorded to bottom	17	2587

"Thirty-barrel daily oil well from Gordon sand."

The record shows the Gantz? (Berea) sand coming 410 feet below the top of the Big Injun. As mentioned in connection with the St. Clara section, page 85, the former sand apparently correlates with the main oil horizon of Yellow creek and Rowles run of Calhoun county.

The two following records are from wells located in the northeast portion of Cove district:

Jacob Ruppert No. 1 Well Record (242).

Located in Cove District, 2¼ miles northwest of Leopold. Authority, Southern Oil Company. Completed Oct. 30, 1905.

(Elevation, 940′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded (no Pittsburgh coal)	1085	1085
Sand, Little Dunkard (I Cow Run)	20	1105
Unrecorded	65	1170
Sand, Big Dunkard? (Burning Springs)	85	1255
Unrecorded	135	1390
Sand, Salt (II Cow Run) (water, 1375′)	98	1488
Unrecorded	42	1530
Salt sand	55	1585
Unrecorded	115	1700
Sand, Maxton? (Salt)	38	1738
Unrecorded	208	1946
Little Lime	44	1990
Unrecorded	10	2000
Big Lime	50	2050
Unrecorded	30	2080
Big Injun sand	82	2162
Unrecorded	264	2426
Sand, Gantz? (Berea)	20	2446
Unrecorded	534	2980
Fifth sand and unrecorded to bottom	28	3008

10″ casing, 170′; 8¼″ casing, 1188′; 6⅝″ casing, 1957′.

"Plugged in Big Injun sand at 2100′. Dry well."

John H. Schmidt No. 1 Well Record (243).

Located in Cove District, 1.1 miles north of St. Clara. Authority, Southern Oil Company. Completed Aug. 19, 1905.

(Elevation, 1095′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	745	745
Coal, Pittsburgh? (Little Pittsburgh?) and unrecorded	420	1165
Sand, Little Dunkard (I Cow Run)	20	1185
Unrecorded	35	1220
Big Dunkard sand	65	1285
Unrecorded	255	1540
Sand, First Salt? (II Cow Run)	50	1590
Unrecorded	130	1720
Salt sand (water)	130	1850
Unrecorded	90	1940
Maxton sand	45	1985
Unrecorded	35	2020
Little lime	20	2040
Unrecorded	40	2080
Big Lime	30	2110
Big Injun sand (some gas)	185	2295
Unrecorded	40	2335
Squaw sand	77	2412
Unrecorded	133	2545
Sand, Gantz? (Berea) (some oil and gas)	25	2570

	Thickness. Feet.	Total Feet.
Unrecorded	270	2840
Gordon shell and unrecorded	200	3040
Fifth sand	5	3045
Unrecorded to bottom	57	3102

10" casing, 284'; 8¼" casing, 1235; 6⅝" casing, none.
"Casing pulled and well abandoned."

The well starts 140 feet above the Washington coal bed. The Washington-Pittsburgh coal interval in this region is 565 feet, according to the St. Clara section, page 85; hence, the Pittsburgh coal should come at a depth of about 705 feet. Thus, the coal at 745 feet apparently represents the Little Pittsburgh bed. Here the Gantz? (Berea) sand comes only 133 feet below the Squaw, and 435 feet below the top of the Big Injun. A light flow of gas was encountered in the Big Injun, and a showing of oil and gas in the Gantz? (Berea).

Southwestward 2 miles, a light gas well (244) was drilled near the head of Fallen Timber run on the Henry U. Wanstreet farm. The horizon at which the gas was struck was not ascertained.

Two miles southwestward, just below the mouth of Fallen Timber, a dry hole (245) was drilled by the Hagerstown Oil Company of Salem, W. Va., on the P. Brannon farm. The writer was unable to obtain the log or any definite information concerning this well.

The South Penn Oil Company in February, 1910, drilled the Andrew Hurst No. 1 well (239), located on Rush run, one mile westward from Leopold, in which a two-million cubic feet daily gas flow was encountered in the Big Injun sand. The well starts 15 feet below the Washington coal bed. Here the drillers reported the Pittsburgh coal as absent from the measures.

As mentioned on a preceding page, the southeast corner of Cove district catches the northwest edge of the Fink oil field. Only four oil wells are within the boundary of the district. The log of one of these wells; viz., Christian Albers No. 8 (248), is published in connection with the St. Clara section, page 85, to which the reader is referred for comments on the oil horizon in the Fink field.

The two following records are from wells in this pool:

John Gamp No. 1 Well Record (249).

Located in Cove District, 1.1 miles south 30° west of St. Clara. Authority, South Penn Oil Company. Completed about 13 years.

(Elevation, 810′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1730	1730
Big Injun sand and unrecorded	435	2165
Sand, Gantz? (Berea) (oil, 2170′)	27	2192
Unrecorded to bottom	8	2200

John Rastle No. 2 Well Record (251).

Located in Freemans Creek District, 2 miles south 10° west of St. Clara. Authority, South Penn Oil Company.

	Thickness. Feet.	Total. Feet.
Unrecorded	1103	1103
Dunkard sand	27	1130
Unrecorded	320	1450
Salt sand	34	1484
Unrecorded	96	1580
Maxton sand	70	1650
Unrecorded	395	2045
Big Lime	42	2087
Big Injun sand	103	2190
Unrecorded	237	2427
Sand, Gantz? (Berea) (oil, light, 2434′) to bottom	27	2454

The well starts on bench of the Washington coal bed. The record of the Chas. Fischer No. 1 well (250), located in the edge of Lewis county, 0.4 mile northwest of the Rastle well (251), was published on page 298 of Vol. I(A) of the State Geol. reports. A brief record of the same well is given in the table of wells for Doddridge county page 290.

The South Penn Oil Company drilled two dry holes (246 and 247) on the Henry Bode and Jos. Krenn farms, located northwest and northeast, respectively, from this oil pool in Cove district.

Prospective Oil and Gas Territory, Cove District.—Although the middle and eastern portions of Cove district have been quite fairly tested for oil and gas, yet there remains a large acreage along its western border that has not been condemned by dry holes, and that is favored both by present development and geologic structure for gas in the Big Injun sand. The Andrew Hurst well (239), located one mile westward from Leopold, was a fine gasser in the Big Injun; hence, all that part of the district lying west of the main channel of Rush run, and west of a line through Grove and the L. G Chapman No. 1 well (233), 0.6 mile northward, appears favorable for Big Injun gas. In the northeast portion of the district, a showing of oil was encountered in the Gantz? (Berea) sand in the John H. Schmidt No. 1 well (243), located 1.1 miles north of St. Clara; hence, there may be a pool of oil at this horizon northward to the Cove-New Milton district line along the structural terrace as outlined by the divergence of the 325 and 375-foot contours of the Pittsburgh coal bed as exhibited on the economic geology map accompanying this report.

NEW MILTON DISTRICT.

New Milton district lies immediately on the northeast from Cove, and is bounded on the southeast by Lewis county. Its northwest corner is traversed in a northeast-southwest direction by the Arches Fork anticline, and the balance of its area lies in the Robinson Basin on the southeast from this great arch in the rocks. On its western border it includes within its area a large portion of the Stout oil pool. All efforts have proved fruitless thus far to extend the Gordon sand oil pool of the eastern portions of McClellan, Grant, and Greenbrier districts southwestward along the Robinson Basin into New Milton district. This is no doubt in a large measure due to the rise in the axis of the Robinson Basin southwestward from its intersection with the Baltimore & Ohio Railroad, 2 miles west of Salem. The extreme southeastern border of New Milton just catches the northwest margin of the Fink oil field of Lewis county, being represented in the district by the W. B. Maxwell No. 1 well (278), located 1.2 miles south of Coldwater. In the northwestern point of the district, there are 15 to 20 gas wells located on or near the crest of the Arches Fork anticline. The two following well records from this locality show the Salt and Big Injun sands to be the main gas horizons:

John Bland No. 1 Well Record (252).

Located in New Milton District, 0.9 mile north of Blandville. Authority, Castle Brook Carbon Black Company.

(Elevation, 855′ B-A. T.)	Thickness. Feet.	Total. Feet.
Conductor	14	14
Unrecorded	36	50
Coal, (Sewickley), and unrecorded	90	140
Sand (with water) and unrecorded	30	170
Sand (with water) and unrecorded	110	280
Coal, Pittsburgh? (Little Clarksburg) and unrecorded	325	605
Coal, Freeport? (Bakerstown) and unrecorded	40	645
Sand, "Gas", (I Cow Run) sand and unrecorded	315	960
Sand, Salt? (Gas and II Cow Run) sand and unrecorded	70	1030
Salt sand (oil, 1035′) and unrecorded to bottom, steel line measurement	31	1061

10″ casing, 253′; 8¼″ casing, 824′.

Well starts about 100 feet below the Uniontown coal; hence, the correlations in parentheses above.

S. L. McClain No. 2 Well Record (253).

Located in New Milton District, 0.6 mile northwest of Blandville Authority, Castle Brook Carbon Black Company.

(Elevation, 855′ B-A. T.)	Thickness. Feet.	Total. Feet.
Conductor	15	15
Unrecorded	125	140
Sand (with water) and unrecorded	365	505
Coal, (Harlem)	10	515
Unrecorded	30	545
Sand, "Gas"? (Moundsville) and unrecorded	193	738
Sand, Cow Run? (Big Dunkard) and unrecorded	112	850
Sand, Salt? ("Gas"), and unrecorded	140	990
Sand, Salt? (II Cow Run) and unrecorded	274	1264
Salt sand and unrecorded	152	1416
Maxton sand and unrecorded	59	1475
Little Lime and unrecorded	20	1495
Big Lime	84	1579
Big Injun sand (gas, 1595′, 1619′) and unrecorded	41	1620
Sand, "Gas"? (part of Big Injun) and unrecorded to bottom	6½	1626½

10″ casing, 150′; 8¼″ casing, 768′; 6⅝″ casing, 1520′.

The well starts about 115 feet below the Uniontown coal bed; hence, the Pittsburgh coal horizon belongs at about 175 feet in the well.

The following is the record of a Big Injun gasser located about half way down the eastern slope of the Arches Fork anticline. The well starts 125 feet below the Washington coal; hence, the Pittsburgh coal horizon should come at about 375 feet in the well:

A. F. Randolph No. 1 Well Record (255).

Located in New Milton District, ½ mile north of New Milton. Authority, Franklin Randolph.

(Elevation, 826' L-A. T.)	Thickness. Feet.	Total. Feet.
Conductor	22	22
Unrecorded	317	339
Coal, Pittsburgh? (Redstone)	11	350
Unrecorded	565	915
Big Dunkard sand and unrecorded	285	1200
Sand, Salt? (II Cow Run) and unrecorded	500	1700
Sand (Maxton) and unrecorded	110	1810
Big Lime	50	1860
Big Injun sand (gas, 1860'; oil, 1900')	80	1940
Unrecorded	270	2210
Black slate and unrecorded	240	2450
Shell and unrecorded	30	2480
Sand and unrecorded	150	2630
Gordon sand and unrecorded	140	2770
Shell and unrecorded	94	2864

Northwestward at Sugarcamp the Preston Oil & Gas Company drilled a gas well (254) on the Franklin Randolph farm in December, 1902. According to information given D. B. Reger, the well had a rock pressure of 850 lbs. to the square inch. So that the gas horizon must have been below the Big Injun sand, probably in the Stray or Gordon.

As mentioned above, the western border of New Milton district catches within its area a larger portion of the Stout oil field, including 55 to 60 Gordon sand oil wells east of the western boundary line of the latter district. The nine following records, arranged roughly from north to south along this border, give interesting data as to the oil and gas horizons in this locality:

Lewis Maxwell No. 1 Well Record (257).

Located in New Milton District, 2 miles west of Sugarcamp. Authority, J. E. Trainer.

	Thickness. Feet.	Total. Feet.
Conductor	40	40
Unrecorded	135	175
Pittsburgh coal	3	178
Unrecorded	402	580

	Thickness. Feet.	Total. Feet.
Sand, Little Dunkard (I Cow Run)	50	630
Unrecorded	100	730
Sand, Big Dunkard? and unrecorded	816	1546
Big Lime	49	1595
Big Injun sand (gas, 1605'-1640'), unrecorded and Stray sand	678	2273
Unrecorded to bottom	71	2344

Although the above log fails to record either oil or the Gordon sand, yet it was reported in the field as a Gordon oil well.

Porter Maxwell No. 34 Well Record (258).

Located in New Milton District, 2¼ miles south 30° west of Blandville. Authority, Michael Murphy. Completed Jan. 16, 1905.

(Elevation, 965' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	2393	2393
Gordon sand (oil)	4	2397
Unrecorded to bottom	18	2415

"6 bbls. daily oil well in Gordon sand."

Porter Maxwell No. 31 Well Record (259).

Located in New Milton District, 2¾ miles southwest of Sugarcamp. Authority, Michael Murphy. Completed March 7, 1904.

(Elevation, 925' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	2367	2367
Gordon sand (oil)	3	2370
Unrecorded to bottom	20	2390

"3 barrel daily oil well in Gordon sand."

The above record shows the Gordon sand only three feet thick on the eastern margin of this oil field, which is in harmony with the suggestion by the writer on a preceding page that the lenticular nature of the Gordon sand in this region is probably responsible for the main portion of the Stout oil pool occupying the high structural level it does.

The record of the W. M. Stout No. 8 well (261), located 1.6 miles southwest from the above well, is published on page 296 of Vol. I(A) of the State Geological reports. It reveals the absence of the Pittsburgh coal in this portion of Doddridge county, as do the records of nearly all the wells in the Stout field.

J. B. Maxwell No. 2 Well Record (262).

Located in New Milton District, 2¼ miles west of Market. Authority, South Penn Oil Company. Completed May 4, 1900.

(Elevation. 1055' B-A. T.)	Thickness. Feet.	Total. Feet.
Conductor	16	16
Unrecorded	1014	1030
Sand, Dunkard (Big Dunkard)	20	1050
Unrecorded	238	1288
Sand, Salt? (II Cow Run)	4	1392
Unrecorded	103	1495
Sand, Maxton? (Salt)	46	1541
Unrecorded	274	1815
Big Lime	65	1880
Big Injun sand	74	1954
Unrecorded	321	2275
Sand, Fifty-foot? (Gantz)	45	2320
Unrecorded	211	2531
Gordon sand (oil)	3	2534
Unrecorded to bottom	28	2562

10" casing, 352'; 8¼" casing, 1035'; 6⅝" casing, 1820'.

The well starts 65 feet, aneroid, below the Washington coal.

A dry hole—J. B. Maxwell No. 1 (263)—was drilled by the same company, 0.3 mile southeast from the above well.

C. C. Pearcy No. 1 Well Record (264).

Located in New Milton District, 2.3 miles west of Market, on Webley fork. Authority, South Penn Oil Company.

(Elevation, 1095'B-A.T.)	Thickness. Feet.	Total. Feet.
Conductor	16	16
Unrecorded	393	409
Sand, Bluff? (Upper Sewickley)	50	459
Unrecorded	586	1035
Sand, Little Dunkard? Sand, Big Dunkard } Big Dunkard and Burning Springs sands	165	1200
Unrecorded	136	1336
Sand, Salt? (II Cow Run and Salt) (water, 1360')	142	1478
Unrecorded	22	1500
Salt sand	75	1575
Unrecorded	16	1591
Salt sand	87	1678
Unrecorded	130	1808
Maxton sand	20	1828
Unrecorded	18	1846
Little lime	25	1871
Pencil cave	10	1881
Blue Monday	22	1903
Big Lime	45	1948
Big Injun (gas, 1972'; oil, 1972'-1985')	53	2001

10" casing, 181'; 8¼" casing, 1185'; 6⅝" casing, 1903'.

This is the only Big Injun sand oil well noted in the field in the Stout oil pool.

L. W. Pearcy Heirs No. 1 Well Record (265).

Located in New Milton District, 1¼ miles east of Kelly. Authority, South Penn Oil Company. Completed August 22, 1900.

(Elevation, 985′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	970	970
Sand, Dunkard (Big Dunkard)	40	1010
Unrecorded	295	1305
Water sand (Salt)	80	1385
Unrecorded	465	1850
Big Lime	40	1890
Big Injun sand	90	1980
Unrecorded	145	2125
Sand, Gantz? (Squaw)	100	2225
Unrecorded	343	2568
Gordon sand (oil, 2568′-2576′)	8	2576

10″ casing, 379′; 8¼″ casing, 1020′; 6⅝″ casing, 1850′.

The well starts about 50 feet below the Washington coal.

John Gribble No. 3 Well Record (266).

Located in New Milton District, 1.5 miles southeast of Kelly. Authority, Carter Oil Company. Completed December 18, 1901.

Elevation, 1135′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	800	800
Cave	540	1340
Sand, Cow Run? (Burning Springs and "Gas")	140	1480
Unrecorded	60	1540
Sand, Salt? (II Cow Run) (water, 1580′)	70	1610
Unrecorded	200	1810
Sand, Maxton? (Salt)	80	1890
Unrecorded	200	2090
Big Lime	50	2140
Big Injun sand	110	2250
Unrecorded	315	2565
Sand, Berea	33	2598
Unrecorded	172	2770
Gordon Stray sand	16	2786
Unrecorded	10	2796
Gordon sand (good oil and gas)	5	2801
Unrecorded to bottom	19	2820

The Pittsburgh coal horizon belongs at about 735 feet in the well.

John M. Gribble No. 2 Well Record (267).

Located in New Milton District, 1¾ miles southeast of Kelly. Authority, Carter Oil Company.

(Elevation, 1100' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1940	1940
Big Lime	37	1977
Big Injun sand	163	2140
Unrecorded	395	2535
Sand, Gantz? (50-foot) (gas in top)	4	2539
Unrecorded	101	2640
Stray sand	10	2650
Unrecorded	5	2655
Gordon sand (oil)	1	2656
Unrecorded to bottom	144	2800

The above is the record of a well located on the extreme eastern margin of the Stout oil pool. The Gordon sand is only one foot thick, illustrating in a striking manner the lenticular nature of this horizon in this region, and, as mentioned in connection with the Porter Maxwell No. 31 well (259) on Lick run, this eastward thinning of the sand prevents the oil from passing down into the Robinson Basin.

Louisa (Fred) Fischer No. 3 Well Record (268)

Located in New Milton District, 1.5 miles northeast of Grove. Authority, Carter Oil Company. Completed Aug. 4, 1900.

	Thickness. Feet.	Total. Feet.
Unrecorded	2010	2010
Big Lime	75	2085
Unrecorded	5	2090
Big Injun sand	115	2205
Unrecorded	522	2727
Gordon sand (oil, 2728')	4	2731
Unrecorded to bottom	232	2963

Several attempts have been made in New Milton district to find oil and gas along the Robinson Basin. At least one-half dozen dry holes have been drilled along or near the axis of this structural trough. On the northeast border of the district, the South Penn Oil Company drilled a dry hole (256) on Redlick run, 1.2 miles eastward from New Milton, on the A. M. Greathouse farm.

The following is the record of another dry hole, 1.7 miles southwestward, nearly on the axis of the syncline. The well starts 20 feet below the Washington coal bed, and in this portion of the county, the Washington-Pittsburgh coal interval is 555 to 560 feet; hence, the coal at 530 feet appears to correlate fairly well with the Pittsburgh bed:

Mary V. Dillon No. 1 Well Record (272).

Located in New Milton District, 1.5 miles northwest of Avon. Authority, J. W. Wilson.

(Elevation, 840' L-A. T.)	Thickness. Feet.	Total Feet.
Unrecorded	530	530
Coal, Pittsburgh	5	535
Unrecorded	525	1060
Sand, Dunkard (Big Dunkard)	50	1110
Unrecorded	110	1220
Gas sand	30	1250
Unrecorded	75	1325
Sand, Salt (II Cow Run and Salt)	295	1620
Unrecorded	195	1815
Maxton sand (hole full of water, 1820')	20	1835
Unrecorded	55	1890
Pencil cave	10	1900
Big Lime	46	1946
Big Injun sand	100	2046
Unrecorded	94	2140
Berea Grit (Squaw)	95	2235
Unrecorded	405	2640
Gordon sand	10	2650
Unrecorded to bottom (no Fifth sand)	192	2842

One mile southeastward two dry holes were drilled; one (273) by the South Penn Oil Company opposite the mouth of Snake run on the John W. Rymer farm; and the other (274) by the Hope Natural Gas Company in 1910 on the south hill side of Snake run, 0.3 mile northeast from the Rymer well, on the J. M. Cox farm.

Southwestward from Meathouse fork the axis of the Robinson syncline dips slightly, forming a shallow, canoe-shaped basin on the head of Toms fork. The records of two dry holes on the James Maxwell (271) and John Gribble (269), located near the low point of the trough, are published on pages 296 and 298 of Vol I(A) of the State Survey reports, and likewise in the Doddridge county table of wells, page 290

Four wells have been drilled in the southeastern corner of New Milton district on the headwaters of Indian fork.

three of which were failures. The two following records are from two of these wells:

Jacob Cox No. 1 Well Record (275).

Located in New Milton District, 1 mile northwest of Coldwater. Authority, Carter Oil Company. Completed May 9, 1899.

	Thickness. Feet.	Total. Feet.
Unrecorded	521	521
Coal, Pittsburgh	5	526
Unrecorded	274	800
Cave	250	1050
Unrecorded	50	1100
Sand, Cow Run (Big Dunkard)	15	1115
Unrecorded	85	1200
Sand, Salt? ("Gas" and II Cow Run)	200	1400
Unrecorded	520	1920
Big Lime	75	1995
Big Injun sand	100	2095
Unrecorded	545	2640
Pencil cave	20	2660
Gordon sand	3	2663
Unrecorded to bottom	197	2860

The well starts 45 feet by hand-level below the Washington coal bed, giving the Washington-Pittsburgh coal interval at 566 feet.

J. C. Cumpston No. 1 Well Record (276).

Located in New Milton District, ¾ mile northwest of Coldwater. Authority, Hope Natural Gas Company. Completed in 1910.

	Thickness. Feet.	Total. Feet.
Unrecorded	2295	2295
Big Injun sand	120	2415
Unrecorded	491	2906
Gordon sand (oil)	5	2911
Unrecorded	112	3023
Fifth sand (gas)	6	3029
Unrecorded to bottom	513	3542

Although a showing of oil was encountered in the Gordon sand, and gas in the Fifth, yet the well was considered dry and abandoned.

The log of the D. H. Nicholson No. 1 well (277), located ½ mile eastward from Coldwater, is published in connection with the section for the latter place, page 86.

As mentioned on a preceding page, the extreme southeast border of New Milton district just catches the northwest edge of the Fink oil pool of Lewis county. The following is the record of the only oil well drilled on the Doddridge county side

W. B. Maxwell No. 1 Well Record (278).

Located in New Milton District, 1¼ miles south 5° east of Coldwater. Authority, South Penn Oil Company.

	Thickness. Feet.	Total. Feet.
Unrecorded	795	795
Pittsburgh Coal	5	800
Unrecorded	440	1240
Sand, Little Dunkard (I Cow Run)	40	1280
Unrecorded	45	1325
Big Dunkard sand	35	1360
Unrecorded	218	1578
Sand, "Gas"? (II Cow Run)	42	1620
Unrecorded	70	1690
Salt sand	45	1735
Unrecorded	260	1995
Maxton sand	15	2010
Unrecorded	40	2050
Little lime	10	2060
Unrecorded	166	2226
Big Lime	72	2298
Big Injun sand	125	2423
Unrecorded	185	2608
Sand, Gantz? (Berea) (oil, 2620')	42	2650
Unrecorded to bottom	3	2653

The above record was published on page 295 of Vol. I(A) of the State Survey reports, but is republished here to correct the correlation of the oil sand, and show the close proximity of the latter to the Big Injun sand above. The identifications in parentheses are by the writer.

Prospective Oil and Gas Territory, New Milton District.—A study of the foregoing records and developments in New Milton district will readily show that a large portion of its area has proved very discouraging to the oil and gas operator; especially so along the Robinson Basin, and on the waters of Indian fork. However, there yet remains a small acreage that is apparently favored both by geologic structure and present development. (1) That portion of the district lying immediately along the axis of the Arches Fork anticline southwestward from Meathouse fork to the New Milton-West Union district line, appears good for both Salt sand and Big Injun gas; (2) that, southwest from Avon to the New Milton-Cove district line, along the apparent structural terrace formed by the divergence of the 325 and 350-foot contours of the Pittsburgh coal bed as outlined on the economic geology map accompanying this report, appears favorable for oil in the Berea and Gordon sands, although the latter has a tendency to thin away in this region; and (3) that, on the extreme head of Indian fork in the immediate vicinity of the W. B. Maxwell No. 1 oil well (278) in the Gantz? (Berea) sand, appears good for several more wells at the same horizon.

GREENBRIER DISTRICT.

Greenbrier district occupies the extreme southeastern part of Doddridge county, and adjoins both Harrison and Lewis. Its entire area lies within the Robinson Basin, but by far the greater portion lies along the east side of the axis of this structural fold. In addition to several scattered gas wells, it has within its boundaries two separate oil pools. One of these is in the Gordon sand and is an extension along the Robinson Basin of the same pool already described in the southeast borders of McClellan and Grant districts. The other is an extension of the Wolf Summit-Jarvisville Fifth sand oil pool of Harrison county southwestward into the region of Big Isaac. Both oil pools apparently terminate to the southwestward within this district.

The development will now be considered from northwest to southeast across the district.

In the extreme northwestern portion of Greenbrier, the Hope Natural Gas Company drilled a dry hole (279) on the D. A. Kelley farm. R. K. Jones of Salem, W. Va., drilled another well (280) of the same kind, 0.5 mile northeastward on the Hick Davis farm.

Eastward in the Robinson Basin there are 60 to 70 Gordon sand oil wells in Greenbrier district on the waters of

Buffalo Calf fork and Greenbrier creek. The six following records are from wells in this region

Minerva Sadler No. 1 Well Record (281).

Located in Greenbrier District, 2 miles southeast of Long Run. Authority, South Penn Oil Company.

(Elevation, 910′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	670	670
Coal, (Pittsburgh) and unrecorded	530	1200
Big Dunkard sand	35	1235
Unrecorded	325	1560
Salt sand	60	1620
Unrecorded	447	2067
Big Injun sand	60	2127
Unrecorded	617	2744
Stray sand	10	2754
Unrecorded	25	2779
Gordon sand (oil)	4	2783
Unrecorded to bottom	296	3079

F. M. Williams No. 1 Well Record (282).

Located in Greenbrier District, 2½ miles south 70° east of Long Run Station. Authority, South Penn Oil Company.

(Elevation, 945′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1215	1215
Big Dunkard sand	20	1235
Unrecorded	310	1545
Salt sand	95	1640
Unrecorded	335	1975
Pencil cave	5	1980
Big Lime	70	2050
Big Injun sand	110	2160
Unrecorded	440	2600
Fifty-foot sand	30	2630
Unrecorded	136	2766
Stray	7	2773
Slate	19	2792
Gordon sand (oil)	7	2799
Unrecorded to bottom	6	2805

M. T. Williams No. 1 Well Record (284).

Located in Greenbrier District, 1¼ miles northwest of Paola. Authority, South Penn Oil Company.

(Elevation, 1000′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	720	720
Coal, (Pittsburgh)	5	725
Unrecorded	525	1250
Dunkard sand	75	1325
Unrecorded	395	1720
Salt sand	160	1880
Unrecorded	140	2020
Big Lime	60	2080
Big Injun sand	80	2160
Unrecorded	430	2590
Fifty-foot sand	40	2630
Unrecorded	50	2680
Thirty-foot sand	20	2700
Unrecorded	85	2785
Stray sand	7	2792
Unrecorded	24	2816
Gordon sand	10	2826
Unrecorded to bottom	10	2836

M. T. Williams No. 5 Well Record (286).

Located in Greenbrier District, 1¼ miles west of Paola. Authority, South Penn Oil Company.

(Elevation, 940′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	660	660
Coal, (Pittsburgh)	5	665
Unrecorded	535	1200
Dunkard sand	60	1260
Unrecorded	377	1637
Salt sand	78	1715
Unrecorded	260	1975
Big Lime	64	2039
Big Injun sand	109	2148
Unrecorded	372	2520
Fifty-foot sand	35	2555
Unrecorded	261	2716
Stray sand (gas)		

M. T. Williams No. 2 Well Record (287).

Located in Greenbrier District, one mile west of Paola. Authority, South Penn Oil Company.

(Elevation, 915′ L-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	630	630
Pittsburgh coal and unrecorded	540	1170
Dunkard sand	80	1250
Unrecorded	380	1630
Sand, Salt (Salt and Maxton)	360	1990
Big Injun sand	90	2080
Unrecorded	415	2495
Fifty-foot sand	20	2515
Unrecorded	75	2590
Thirty-foot sand	20	2610
Unrecorded	76	2686
Stray sand	12	2698
Unrecorded	27	2725
Gordon sand (oil)	11	2736
Unrecorded to bottom	12	2748

Charlotte Clark No. 3 Well Record (289).

Located in Greenbrier District, ½ mile west of Paola. Authority, South Penn Oil Company.

(Elevation, 938′ L-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	730	730
Coal, (Pittsburgh)	5	735
Unrecorded	515	1250
Dunkard sand	60	1310
Unrecorded	455	1765
Salt sand	85	1830
Unrecorded	200	2030
Big Lime	60	2090
Big Injun sand	120	2210
Unrecorded	385	2595
Fifty-foot sand	15	2610
Unrecorded	158	2768
Stray sand	15	2783
Unrecorded	25	2808
Gordon sand (oil)	14	2822
Unrecorded to bottom	14	2836

The complete logs of the two following wells are published on the pages indicated of Vol. I(A) of the State Geological reports; also in brief in the table of wells for Doddridge county:

Map No.	Name of Well.	Location	Page of Vol. I(A).
288	Marcellus Clark No. 2....	1.1 miles N. W. of Miletus.	293
290	R. G. Davis No. 3.........	1.0 mile N. W. of Miletus..	293

Both are located on Greenbrier creek, and produce oil from the Gordon sand.

Recently a 25-barrel daily well in the Gordon sand was completed by Randolph and Ward, one mile to the southwestward of the Greenbrier creek pool on the J. J. Adams farm (297A). Another small oil well in the Gordon was drilled 1.3 miles southwest from the Adams well (297A) on Hunter fork, the record of which is as follows:

J. H. Meeks No. 1 Well Record (299).

Located in Greenbrier District, 1½ miles southwest of Zinnia. Authority, Southern Oil Company. Completed June 24, 1902.

	Thickness. Feet.	Total. Feet.
Unrecorded	600	600
Pittsburgh coal and unrecorded	2126	2726
Gordon sand (oil)	6	2732
Unrecorded to bottom	10	2742

6⅝" casing, 2075'.

The oil showing in the last two wells makes it appear that if the Greenbrier creek pool does extend southwest into New Milton district, that it passes via Avon and May, probably resting upon the structural terrace as exhibited by the Pittsburgh coal contours at the last mentioned locality. Two dry holes on Hunter fork to the northwest of the Meeks well (299) shut it off in that direction, while another (300), located on the head of Hunter fork on the G. W. Burnside farm, prevents it passing southward. The Maxwell Heirs No. 1 well (296) is a gasser in the Big Injun, Gordon Stray, and Gordon sands. It is located one-half mile south of Miletus, and its detailed log is published in connection with the section for Miletus, page 88.

The two following records are from gas wells located higher up the structural slope on the head of Indian fork of Buckeye creek:

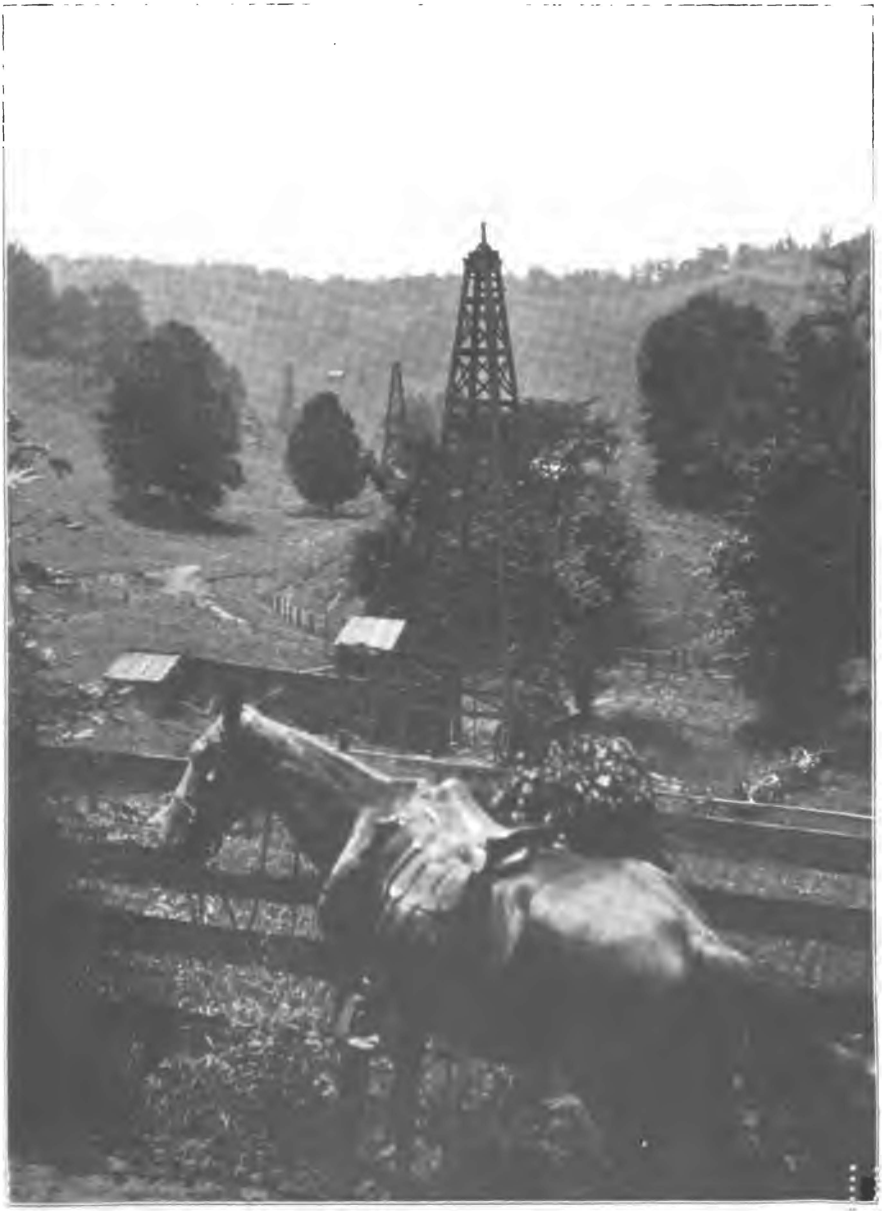


PLATE XI.—Another view of the Stout Oil Field and Topography of the Dunkard series.

Jas. Richards No. 1 Well Record (301).

Located in Greenbrier District, 1¼ miles south 5° east of Zinnia. Authority, Salem Natural Gas Company. Completed Sept. 27, 1909.

(Elevation, 980′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	30	30
Native coal, (Washington)	2	32
Unrecorded	48	80
Water sand	10	90
Unrecorded	538	628
Pittsburgh coal	7	635
Unrecorded	435	1070
Sand, Dunkard (I Cow Run)	40	1110
Unrecorded	160	1270
Sand, First gas ("Gas" sand)	25	1295
Unrecorded	75	1370
Sand, Salt? (**II Cow Run**) (water, 1380′, 2 bailers per hour)	45	1415
Unrecorded	85	1500
Salt sand	30	1530
Unrecorded	30	1560
Salt sand (water, 1675′; 7 bailers per hour)	145	1705
Unrecorded	25	1730
Maxton sand	54	1784
Unrecorded	236	2020
Big Lime	55	2075
Big Injun sand	55	2130
Slate	6	2136
Squaw sand	25	2161
Unrecorded	245	2406
Berea Grit	34	2440
Slate and shell	10	2450
Gantz sand	85	2535
Fifty-foot sand	25	2560
Red rock	15	2575
White slate and shell	45	2620
Thirty-foot sand	20	2640
Unrecorded	37	2677
Gordon Stray sand (gas, 2678′)	13	2690
Black slate	18	2708
Gordon sand (gas, 2718′. and slight show of oil in bottom of sand)	20	2728
Unrecorded	10	2738
Fourth sand (lime)	30	2768
Unrecorded	125	2893
Gritty lime	15	2908
Slate to bottom	21	2929

"250,000 cu. ft. of gas in Gordon Stray sand; 250,000 cu. ft. of gas in Gordon sand."

L. C. Hickman No. 1 Well Record (302).

Located in Greenbrier District, 1¼ miles northeast of Zinnia. Authority, Salem Natural Gas Company. Completed Aug. 3, 1896.

(Elevation, 975' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1985	1985
Big Injun sand (half enough gas to run boiler, 2020')	75	2060
Unrecorded	521	2581
Gordon sand (gas, 2582', 2622') and unrecorded to bottom	227	2808

"Present production, 500,000 cu. ft. gas daily."

During 1910 the Hope Natural Gas Company drilled the D. E. Cox (Nicholson) No. 1 well (307), located on Meathouse fork, one mile southeast from Avon, in which a showing of gas and oil was reported in the Gordon sand, and a gas flow in the Fourth.

The following is the record of a well in the extreme southern point of Greenbrier district, in which a showing of oil was struck in the Big Injun sand. The well starts 50 feet below the Washington coal:

Edgar Davisson No. 1 Well Record (308).

Located in Greenbrier District, 1.2 miles east of Coldwater. Authority, South Penn Oil Company.

(Elevation, 1005' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	960	960
Sand, Cow Run (I Cow Run)	55	1015
Unrecorded (water, 1330'-1460')	495	1510
Salt sand	165	1675
Unrecorded	185	1860
Maxton sand	15	1875
Unrecorded	70	1945
Big Lime	55	2000
Big Injun sand (oil show, 2035')	160	2160
Unrecorded	376	2536
Sand, Stray? (30-foot)	54	2590
Unrecorded	31	2621
Gordon sand	14	2635
Slate	27	2662
Unrecorded to bottom	327	2989

The two following records are from gas wells in the eastern portion of the district:

L. D. Waugh No. 1 Well Record (303).

Located in Greenbrier District, 1.5 miles northwest of Big Isaac. Authority, W. S. Bond.

(Elevation, 1165′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	125	125
Coal, native, (Washington)	2	127
Unrecorded	263	390
Coal, (Uniontown)	7	397
Unrecorded	303	700
Coal, Pittsburgh	8	708
Unrecorded	444	1152
Sand, Little Dunkard (I Cow Run)	28	1180
Unrecorded	35	1215
Big Dunkard sand	25	1240
Unrecorded	180	1420
Gas sand	44	1464
Unrecorded	106	1570
First Salt sand	58	1628
Unrecorded	5	1633
Second Salt sand	147	1780
Unrecorded	135	1915
Maxton sand	24	1939
Unrecorded	116	2055
Pencil cave	5	2060
Big Lime	30	2090
Big Injun sand		

A gasser in Gordon and Fourth sands. Did not obtain the log below top of the Big Injun.

J. B. Corder No. 1 Well Record (311).

Located in Greenbrier District, 2 miles southwest of Big Isaac. Authority, Hoffmeier-Deegans Oil & Gas Company.

(Elevation, 1040′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	552	552
Pittsburgh coal	4	556
Unrecorded	414	970
Sand, Little Dunkard (I Cow Run)	66	1036
Unrecorded	94	1130
Sand, Big Dunkard? (Burning Springs)	20	1150
Unrecorded	20	1170
Gas sand	80	1250
Unrecorded	105	1355
Sand, Salt? (II Cow Run)	20	1375
Unrecorded	23	1398
Salt sand	22	1420
Unrecorded	32	1452
Salt sand	206	1658
Unrecorded	88	1746

	Thickness. Feet.	Total. Feet.
Maxton sand	25	1771
Unrecorded	115	1886
Little lime	14	1900
Unrecorded	20	1920
Big Lime	60	1980
Big Injun sand	106	2086
Unrecorded	49	2135
Squaw sand	55	2190
Unrecorded	130	2320
Berea Grit	25	2345
Unrecorded	150	2495
Thirty-foot sand	25	2520
Unrecorded	58	2578
Gordon Stray sand	31	2609
Unrecorded	10	2619
Gordon sand (gas pay, 2621' and 2629')	22	2641
Unrecorded	169	2810
Fifth sand to bottom	99	2909

As mentioned on a preceding page, the extreme eastern point of Greenbrier district catches a small portion of the Fifth sand oil pool of Harrison county. About one dozen oil wells are included in the district. The log of one of these wells; viz., Geo. T. Richards No. 3 well (315), is published in connection with the section for Big Isaac, page 89.

The following record, taken from page 293 of Vol. I(A) of the State Geological Survey reports, shows the relation of the Fifth sand to other well known formations:

William Mowry No. 1 Well Record (317).

Located in Greenbrier District, ¾ mile north of Big Isaac. Authority, South Penn Oil Company.

(Elevation, 1190' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	700	700
Coal, Pittsburgh	4	704
Unrecorded	491	1195
Big Dunkard sand	35	1230
Unrecorded	445	1675
Salt sand	175	1850
Unrecorded	150	2000
Maxton sand	35	2035
Unrecorded	40	2075
Big Lime	50	2125
Big Injun sand	150	2275
Unrecorded	200	2475
Berea sand	15	2490
Unrecorded	110	2600

	Thickness. Feet.	Total. Feet.
Fifty-foot sand	35	2635
Unrecorded	135	2770
Stray sand	15	2785
Unrecorded	13	2798
Gordon sand	42	2840
Unrecorded	164	3004
Fifth sand (oil)	12	3016
Unrecorded to bottom	65	3081

The above log shows the oil horizon coming 2304 feet below the top of the Pittsburgh coal bed, and 164 feet below the Gordon sand.

In addition to the summarized records of the following list of wells in the Doddridge county table of wells, page 290, their detailed records are given on the pages indicated of Vol. I(A) of the State Geological Survey reports:

Map No.	Name of Well.	Location.	Page of Vol. I(A).
313	J. T. Sommerville No. 2..	0.5 mile N. E. of Big Isaac.	294
314	A. D. Lawson No. 6......	0.75 mile N. E. of Big Isaac	336
316	W. Mowry No. 2..........	0.9 mile N. E. of Big Isaac.	294

As mentioned on a preceding page, the Chas. Slusser No. 1 well (305), located 0.8 mile westward from Big Isaac, was the first gas well drilled in the county.

Prospective Oil & Gas Territory, Greenbrier District.—As with all the other districts of Doddridge county, there yet remains a large acreage that appears to be favored both by geologic structure and present development for oil and gas. (1) That portion of the district extending in a narrow belt, ¼ to 1 mile wide, northeastward from the J. H. Meeks No. 1 well (299) on Hunter fork via J. J. Adams No. 1 well (297A) to Greenbrier creek, appears good for Gordon sand oil; (2) that, drained by Johnson fork of Meathouse fork, and northeastward to Big Isaac creek, appears good for gas; (3) and that, drained by Hughes run, eastward from Miletus, is favorable for gas in the Big Injun and Gordon sands.

HARRISON COUNTY WELL RECORDS.

The accompanying table of 435 wells for Harrison county contains the abbreviated logs of 290 borings as well as levels on most of same, along with elevations on the top of the hole and other data on 145 other wells of which the writer was unable to obtain the records at this time. As with the Doddridge county list, these wells have been selected from the great number drilled in the county on account of their wide distribution, and in many instances on account of some special feature associated with the well. The borings are numbered from 318 to 741, and grouped first by magisterial districts and then by oil and gas pools; thus, Nos. 318 to 395 inclusive are located in Sardis district, and likewise, 396 to 477 are in Ten Mile district. The serial number in each instance corresponds to the map number of the same well as given on the economic geology map accompanying this report. For further particulars the reader is referred to the explanations preceding the table of wells for Doddridge county, page 290.

Under the column headed "Owner" in the Harrison county table of well records, the following abbreviations are used:

Blackstone	Blackstone Oil & Gas Company.
Bridgeport	Bridgeport Oil & Gas Company.
Burt	Burt Oil Company.
Carnegie	Carnegie Natural Gas Company.
Clarksburg	Clarksburg Light & Heat Company.
Clarksburg O.	Clarksburg Oil & Gas Company.
Carter	Carter Oil Company.
Consolidation	The Consolidation Coal Company.
Crude	The Crude Oil Company.
Diamond	The Diamond Company.
Fair Ground	Fair Ground Improvement Co.
Fairmont & Grafton	Fairmont & Grafton Gas Company.
Fearless	Fearless Oil Company.
Fisher & Phila.	Fisher Oil Co. and Philadelphia Co.
Fuel City	Fuel City Oil & Gas Company.
Gartlan	Gartlan Drilling Company.

Graselli	Graselli Chemical Company.
Harbert O. & G.	Harbert Oil & Gas Company.
Hartman	Hartman Oil Company.
Haywood O. & G.	Haywood Oil & Gas Company.
Hope	Hope Natural Gas Company.
Horner	Horner Gas Supply Company.
Independent	Independent Oil & Gas Company.
Industrial	Industrial Oil & Gas Company,
Kinch O. & G.	Kinch Oil & Gas Company.
Lost Creek	Lost Creek Oil & Gas Company.
Lumberport	Lumberport Gas Company.
Mandell O. & G.	Mandell Oil & Gas Company.
Marshville	Marshville Oil Company.
Miller & Co.	Geo. E. Miller & Company.
Moon O. & G.	Moon Oil & Gas Company.
Mt. Clare Gas	Mt. Clare Gas Company.
Peerless	Peerless Carbon Black Company.
Penna. O. & G.	Pennsylvania Oil & Gas Company.
Phila	Philadelphia Company.
Raven Carbon	Raven Carbon Company.
Realty O. & G.	Realty Oil & Gas Company.
Reserve	Reserve Gas Company.
Run Smooth	Run Smooth Oil & Gas Company.
Southern	Southern Oil Company.
South Penn	South Penn Oil Company.
Tri-State	Tri-State Gas Company.
Tygart O. & G.	Tygart Oil & Gas Company.
United States	United States Oil Company.
Vesper Gas	Vesper Gas Company.
Washington	Washington Gas Company.
Weston G. Co.	Weston Gas Company.
Wheeling	Wheeling Natural Gas Company.

In the elevation column, the letter "B" indicates that the elevation of the top of the hole was obtained by aneroid checked with nearby U. S. G. Survey spirit level elevations; the letter "L," by spirit level measurement. These elevations are expressed in feet above tide. Depths and thicknesses of formations are given in feet.

Summarized Record of Wells in

Map No.	NAME OF WELL	Location—District	OWNER	Elevation A. T.
318	Geo. Wyvel No. 1	Sardis	South Penn	1460B
319	Mary Hall No. 2	Sardis	South Penn	1360B
320	O. E. Heldreth No. 2	Sardis	South Penn	1205B
321	E. L. Piggott No. 1	Sardis	Southern	1590B
322	E. T. Bennett No. 1	Sardis	South Penn	1109L
323	Mary E. Heldreth No. 1	Sardis	South Penn	1095B
324	Mary A. Bennett No. 2	Sardis	South Penn	1150B
325	F. A. Parrish No. 3	Sardis	South Penn	1075B
326	Alva Robinson No. 1	Sardis	South Penn	1055B
327	Jesse Talkington No. 3	Sardis	South Penn	1150B
328	Malissa Kelley No. 1	Sardis	South Penn	1275B
329	Fred'k Robinson No. 1	Sardis	Hope	1170B
330	Benj. Heldreth No. 1	Sardis	Roland & Groves	......
331	J. C. Baker No. 1	Sardis	South Penn	1075B
332	Jesse Talkington No. 1	Sardis	South Penn	......
333	Acena Talkington No. 2	Sardis	South Penn	1295B
334	W. R. G. Hall No. 5	Sardis	South Penn	1220B
335	John Stout No. 2	Sardis	South Penn	1115B
336	Omar E. Hall No. 1	Sardis	South Penn	1125B
337	S. A. Cavalier No. 4	Sardis	South Penn	1150B
338	Omar E. Hall No. 3	Sardis	South Penn	......
339	G. W. Talkington No. 11	Sardis	South Penn	1125B
340	G. W. Talkington No. 14	Sardis	South Penn	1125B
341	G. W. Talkington No. 15	Sardis	South Penn	1100B
342	L. E. Bartlett No. 1	Sardis	South Penn	1050B
343	Wesley Robinson No. 5	Sardis	South Penn	1080B
344	S. N. Parrish No. 2	Sardis	South Penn	1040B
345	F. J. Parrish No. 1	Sardis	South Penn	1015B
346	F. J. Parrish No. 2	Sardis	South Penn	1115B
347	Woodfield-Sprout No. 1	Sardis	South Penn	1100B
348	O. S. Ritter No. 1	Sardis	South Penn	......
349	Bates-Harbert No. 1	Sardis	South Penn	1041L
350	W. C. Lambert No. 1	Sardis	South Penn	1125B
351	John Hearld No. 1	Sardis	Wheeling	1110L
352	B. L. Rogers No. 2	Sardis	Wheeling	1215B
353	Felix Coffman No. 1	Sardis	Carter	1120B
354	E. D. Orr No. 1	Sardis	South Penn	1030B
355	T. C. Bennett No. 3	Sardis	South Penn	1220B
356	Z. L. McIntyre No. 1	Sardis	South Penn	1150B
357	T. C. Bennett No. 1	Sardis	South Penn	1140B
358	Henry Stewart No. 1	Sardis	South Penn	1160B
359	Geo. Talkington Heirs No. 1	Sardis	South Penn	1165B
360	F. M. Gifford No. 1	Sardis	Benedum & Trees?	1065B
361	Nathan Goff No. 39	Sardis	Nathan Goff	1053L
362	Nathan Goff No. 45	Sardis	Nathan Goff	1065B
363	Margaret McIntyre No. 2	Sardis	Benedum & Trees	1020B
364	M. K. Davisson No. 1840	Sardis	Phila	1065B
365	W. A. Rogers No. 2	Sardis	South Penn	1325B
366	E. L. Dennison No. 1	Sardis	South Penn	1015B

Harrison County.

PITTSBURGH COAL			BIG INJUN SAND		GORDON SAND		Total Depth	PRODUCING SAND	Map No.
Depth (top)	Elevation (top A.T.	Thickness	Depth (top)	Thickness	Depth (top)	Thickness			
1348	112	6	2610	90	3443	......	3462	Gordon	318
1245	115	6	2410	98	3318	25	3359	Gordon	319
1060	145	5	2340	90	3136	29	3166	Gordon	320
1498	92	......	......	......	3554	......	......	Stray	321
914	195	5	2185	105	3006	38	3067	Gordon	322
908	187	4	2019	93	2984	34	3033	Gordon	323
961	189	......	2250	105	3042	19	3061	Gordon	324
845	230	11	2121	101	2930	38	2998	Gordon	325
830	225	......	2110	90	2903	27	3232	Gordon	326
974	176	5	2260	100	3039	30	3099	Gordon	327
930	345	......	......	......	......	......	1415	Moundsville	328
......	......	......	......	......	......	......	......	————	329
......	......	......	......	......	......	......	......	Gordon	330
......	......	......	2130	125	......	......	3240	30-ft.	331
1172	......	5	2430	130	3260	30	3308	Stray and Gordon.......	332
1155	140	3	2425	120	3240	16	3256	30-ft. and Stray.........	333
1085	135	3	2275	170	3150	......	3240	Gordon	334
980	135	5	2240	110	3047	19	3070	Stray and Gordon.......	335
975	150	5	2215	110	3046	20	3180	B. I., Stray and Gordon..	336
1008	142	5	2265	120	3065	......	3091	Gordon	337
1280	......	7	2478	42	3358	19	3378	Stray and Gordon.......	338
950	175	5	2240	150	3005	27	3091	Gordon	339
925	200	4	2190	160	3003	30	3033	Gordon	340
898	202	3	2164	130	2979	30	3362	Gordon	341
780	270	......	2054	127	2854	38	2902	B. I. and Gordon........	342
790	290	5	2105	110	2875	45	2925	B. I. and Gordon........	343
753	287	7	2011	131	2815	42	2902	Gordon	344
726	289	......	1970	160..	2799	40	3236	Gordon	345
1024	91	......	2298	120	3106	22	3143	Gordon	346
900	200	4	2180	......	2965	23	3028	Stray and Gordon.......	347
835	275	10	2109	86	2932	30	2975	B. I., Stray and Gordon.	348
850	191	5	2110	100	2925	21	2977	Gordon	349
......	......	......	2270	96	3081	19	3100	Gordon	350
860	250	8	2150	86	2955	......	2965	B. I. and Gordon........	351
920	295	6	......	103	3007	22	3034	B. Dunk., B. I., Gordon..	352
865	255	10	2180	90	2935	10	2972	Stray and Gord.........	353
......	......	......	......	......	......	......	......	Gordon	354
1012	208	8	2310	105	3094	23	3165	Gordon	355
930	220	9	2180	120	3006	54	3060	Stray and Gord.........	356
924	216	10	2232	100	3000	42	3083	Gordon	357
......	......	......	......	......	......	......	......	————	358
......	......	......	2334	140	3139	28	3221	Gordon	359
830	235	......	2125	120	2902	20	2922	50-ft. and Gordon.......	360
826.5	226.5	......	2144	92	2918	22	2940	Gordon	361
828	237	6	2112	98	2895	30	2952	Gordon	362
700	320	......	2010	96	2775	23	2811	Gordon	363
747	318	9	2042	113	2834	41	3147	50-ft. and Gordon.......	364
950	375	6	2260	102	3026	34	3060	Gordon	365
......	......	......	......	......	......	......	......	————	366

Summarized Record of Wells in

Map No.	NAME OF WELL	Location—District	OWNER	Elevation A. T.
367	Marshall Bailey No. 1	Sardis	Hartman	990B
368	Calvern Bailey No. 1	Sardis	——————	995B
369	T. P. Whiteman No. 1	Sardis	South Penn	1040B
370	S. T. Flanagan No. 1	Sardis	Phila	1175B
371	Noah Harbert No. 1	Sardis	Hope	1180B
372	E. E. S. Rogers No. 2140	Sardis	Phila	1060B
373	I. L. Marsh No. 1	Sardis	——————	1005B
374	Temple Smith No. 2107	Sardis	Phila	1115B
375	G. W. Kelley No. 1	Sardis	Carnegie	1070B
376	Blackburn Smith No. 1	Sardis	South Penn	1050B
377	Seth Piggott No. 1	Sardis	Hartman	1145B
378	Seth Piggott No. 1	Sardis	South Penn	1125B
379	J. L. Swiger No. 1	Sardis	Hartman	1110B
380	Sam'l Williams No. 1	Sardis	Hope	1235B
381	John G. Rogers No. 1	Sardis	Hope	1300B
382	W. N. Edgell No. 2147	Sardis	Phila	1005B
383	H. H. Huston No. 1	Sardis	Carnegie	965B
384	E. L. Haggerty No. 1	Sardis	Hope	1140B
385	A. A. Swiger No. 1	Sardis	Hope	1090B
386	L. S. Whiteman No. 1	Sardis	Hope	1325B
387	Wm. T. Allen No. 1	Sardis	Carnegie	985B
388	Nancy Griffin No. 6	Sardis	Hope	980B
389	Benj. Bramer No. 1	Sardis	Hope	985B
390	W. M. Strother No. 1	Sardis	South Penn	1535B
391	Thos. J. Strother No. 1	Sardis	South Penn	1130B
392	O. Robinson No. 2159	Sardis	Phila	955B
393	Jas. Flanagan No. 2145	Sardis	Phila	1150B
394	Louisa C. Swiger No. 1	Sardis	Hope	1004L
395	Clara Fortney No. 1	Sardis	Hope	965B
396	John Goodwin No. 2	Ten Mile	Hope	1165B
397	John T. Goodwin No. 1	Ten Mile	Hope	1075B
398	E. L. Dennison No. 1	Ten Mile	South Penn	1100B
399	Jas. M. Morris No. 2	Ten Mile	South Penn	1065B
400	Geo. P. Nuzum No. 1	Ten Mile	South Penn	1175B
401	E. M. Estlack No. 2	Ten Mile	South Penn	1075L
402	T. D. Rogers No. 1	Ten Mile	South Penn	1395B
403	J. Lough No. 1	Ten Mile	Gartlan	1290B
404	G. W. Williams No. 1	Ten Mile	South Penn	1026L
405	Luther Haymond No. 15	Ten Mile	South Penn	1140B
406	Luther Haymond No. 1	Ten Mile	South Penn	1435B
407	Wm. Hickman No. 1	Ten Mile	Gartlan	1075B
408	J. W. Williams No. 1	Ten Mile	U. S. Oil Co.	1020B
409	J. W. Williams No. 2	Ten Mile	U. S. Oil Co.	1135B
410	Susan Barnes No. 5	Ten Mile	South Penn	1085B
411	J. W. Williams No. 8	Ten Mile	United States	1018L
412	J. W. Williams No. 6	Ten Mile	United States	......
413	A. C. Bailey No. 1	Ten Mile	South Penn	1345L
414	A. J. Varner No. 8	Ten Mile	South Penn	......
415	A. C. Bailey No. 8	Ten Mile	South Penn	1145B

Harrison County.—Continued.

PITTSBURGH COAL			BIG INJUN SAND		GORDON SAND		Total Depth	PRODUCING SAND	Map No.
Depth (top)	Elevation (top) A. T.	Thickness	Depth (top)	Thickness	Depth (top)	Thickness			
295	695	......	1660	......	2369	18	2742	————	367
......	......	......	......	......	......	......	1000	————	368
......	......	......	1880	150	2677	33	2963	————	369
775	400	7	2077	123	2856	......	......	50-ft., 30-ft., Stray, Gord.	370
753	427	......	......	......	......	......	......	50-ft.	371
476	584	10	1796	100	2572	49	2631	30-ft., 50-ft. and 4th	372
438	567	10	1765	102	......	......	1867	B. I.	373
590	525	6	1910	125	......	......	2535	B. I. and 50-ft	374
570	500	7	1885	113	2681	22	2882	50-ft. and 30-ft	375
......	......	......	......	......	......	......	......	————	376
622	523	......	1940	......	2750	30	2845	————	377
590	525	8	1912	80	2760	20	3001	Stray	378
558	552	......	1855	110	2717	16	3635	————	379
473	762	......	......	......	......	......	......	————	380
570	730	6	1900	80	......	......	1988	B. I.	381
290	715	15	1644	100	2370	(120)	2796	————	382
106	859	......	1490	94	......	......	2316	Stray and 4th	383
......	......	......	1420	70	2220	20	2465	B. I., and 5th	384
......	......	......	......	......	......	......	......	Max	385
......	......	......	......	......	......	......	......	Gordon	386
......	......	......	......	......	......	......	......	————	387
......	......	......	......	......	......	......	1361	Max	388
......	......	......	......	......	......	......	......	B. I.	389
......	......	......	......	......	......	......	......	————	390
......	......	......	......	......	......	......	......	————	391
......	......	......	1270	110	2020	30	2266	30-ft. and 5th	392
......	......	......	1443	95	2136	20	-2602	5th	393
......	......	......	1256	......	......	......	1285	B. I.	394
......	......	......	......	......	......	......	......	————	395
......	......	......	......	......	......	......	......	————	396
860	215	6	2170	130	2927	25	2969	50-ft. and Gord	397
......	......	......	......	......	......	......	......	Gordon	398
825	240	......	......	......	......	......	......	Gordon	399
......	......	......	2210	60	3047	20	3210	————	400
......	......	......	2120	90	2880	34	2967	Gordon	401
1053	342	5	2350	100	3129	31	3160	Gordon	402
935	355	5	2260	85	3005	33	3038	50-ft. and Gordon	403
......	......	......	......	......	......	......	......	Gordon	404
905	235	6	2215	95	2967	21	3012	Gordon	405
1215	220	5	2525	95	3299	11	3609	Stray and Gordon	406
735	340	......	......	......	2810	10	2825	30-ft.	407
710	310	......	2010	......	2786	24	2810	Gordon	408
825	310	......	2115	......	2886	21	2907	Gordon	409
770	315	7	2095	......	2839	22	2923	Gordon	410
683	335	......	......	......	2749	20	2769	Gordon	411
890	......	......	......	......	2968	24	2992	Stray and Gordon	412
1145	200	5	2560	70	3224	19	3483	Stray and Gordon	413
945	......	5	2240	115	3010	12	3023	Gordon	414
945	200	......	2240	115	3018	26	3044	Gordon	415

Summarized Record of Wells in

Map No.	NAME OF WELL	Location—District	OWNER	Elevation A. T.
416	Thos. Williams No. 1	Ten Mile	South Penn	1175
417	James Morris No. 3	Ten Mile	South Penn	1170L
418	Jos. Rosier Heirs No. 1	Ten Mile	Moon	1055L
419	Eliz. Moon No. 3	Ten Mile	Moon	1243L
420	Eliz. Moon No. 1	Ten Mile	Moon	1175B
421	Martha Traugh No. 1	Ten Mile	Gartlan	1085B
422	M. V. Davisson No. 1	Ten Mile	South Penn	1090B
423	A. W. P. Flanagan No. 2	Ten Mile	South Penn	......
424	G. E. Harbert No. 1	Ten Mile	Carter	1160B
425	M. Davisson No. 11	Ten Mile	South Penn	1163L
426	John F. Randolph No. 1	Ten Mile	South Penn	1130B
427	Industrial Home No. 2	Ten Mile	Industrial	1075B
428	Industrial Home No. 1	Ten Mile	Industrial	1070B
429	Ella Meek No. 1	Ten Mile	Hope	1230B
430	Homer Bartlett No. 1	Ten Mile	South Penn	1049L
431	Sam'l Gaines No. 2	Ten Mile	South Penn	1112L
432	Silas Fittro No. 1	Ten Mile	South Penn	1280L
433	Silas Fittro No. 2	Ten Mile	South Penn	1360L
434	Patterson No. 3	Ten Mile	R. T. Lowndes	1115B
435	John Flint No. 2	Ten Mile	Southern	1140B
436	Columbus Gain No. 1	Ten Mile	Southern	1223L
437	T. S. Morris No. 1	Ten Mile	Kinch O. & G	1265B
438	Harriet Williams No. 1	Ten Mile	Marshville	1085B
439	Chas. Lanham No. 1	Ten Mile	Kinch O. & G	......
440	Frank Graves No. 1	Ten Mile	Realty O. & G	1000B
441	Chas. Lanham No. 1	Ten Mile	South Penn	965B
442	S. Fretto No. 4	Ten Mile	South Penn	1005B
443	D. Boughner No. 1	Ten Mile	South Penn	1365B
444	B. H. Brown No. 13	Ten Mile	South Penn	995B
445	B. H. Brown No. 12	Ten Mile	South Penn	1185B
446	F. M. Haney No. 1	Ten Mile	Groves & Roland	970L
447	Jesse A. Harbert No. 1	Ten Mile	Harbert	1160B
448	Wilson Williams No. 1	Ten Mile	South Penn	1400B
449	J. W. Dennison No. 13	Ten Mile	South Penn	1380B
450	M. Dolan No. 1	Ten Mile	Hope	1205B
451	Fultz Heirs No. 1092	Ten Mile	Hope	1070B
452	H. M. Turner No. 1	Ten Mile	Washington	1165B
453	Copeland Heirs No. 1	Ten Mile	Washington	1150B
454	Hiram Lynch No. 14	Ten Mile	South Penn	1345B
455	Hiram Lynch No. 3	Ten Mile	South Penn	1015B
456	J. G. Dakon No. 3	Ten Mile	Independent	1192L
457	Hiram Lynch No. 44	Ten Mile	South Penn	1110B
458	John Haney No. 1	Ten Mile	Trainer Bros	1025B
459	Robinson No. 1	Ten Mile	Despard et al	1195B
460	A. D. Parr No. 1	Ten Mile	Phila	1140B
461	S. S. Cross No. 1	Ten Mile	Hope	1195B
462	Alonzo Rhodes No. 1	Ten Mile	Trainer Bros	1130B
463	J. M. Fultz No. 6	Ten Mile	South Penn	1350B
464	J. M. Fultz No. 4	Ten Mile	South Penn	1140B

Harrison County.—Continued.

PITTSBURGH COAL			BIG INJUN SAND		GORDON SAND		Total Depth	PRODUCING SAND	Map No.
Depth (top)	Elevation (top) A. T.	Thickness	Depth (top)	Thickness	Depth (top)	Thickness			
967	208	5	2260	65	3033	15	3069	Gordon	416
860	310	5	2200	105	2916	30	3410	Gordon	417
730	325	6	2076	75	2805	19	2841	30-ft. and Gordon	418
938	305	6	2288	......	......	......	......	————	419
846	329	7	2192	88	2916	21	2966	Stray and Gordon	420
780	305	6	2135	85	2847	17	2868	Gordon	421
860	230	6	2175	110	2913	19	2960	B. I. and Gordon	422
890	......	8	2223	90	2968	19	2990	Gordon	423
960	200	10	2298	107	2992	20	3061	B. I., Gord. & 4th	424
945	218	5	2275	110	3042	10	3052	Gordon	425
918	212	6	2235	67	2984	8	2992	Gordon	426
......	......	......	......	......	......	......	......	Gordon	427
......	......	......	......	......	......	......	......	————	428
900	330	......	......	......	......	......	3378	————	429
......	......	......	......	......	......	......	......	Gordon	430
......	......	......	2190	14	2912	16	2939	Gordon	431
1010	270	5	2356	144	3090	16	3191	Gordon	432
1092	268	3	2442	50	3165	17	3193	Gordon	433
772	343	6	2137	92	2851	16	2888	Stray and Gordon	434
790	350	......	......	......	2878	15	2895	Gordon	435
885	338	......	......	......	2965	16	2981	Gordon	436
......	......	......	......	......	......	......	......	Max	437
......	......	......	......	......	......	......	......	Gordon	438
......	......	......	......	......	......	......	......	————	439
178	822	......	......	......	......	......	......	Gordon	440
150	815	......	......	......	......	......	......	Gordon	441
......	......	......	......	......	......	......	......	5th	442
500	865	5	1920	80	2630	70	2879	5th	443
195	800	3	1590	50	2327	40	2578	5th	444
400	785	8	1830	90	2515	60	2610	5th	445
406	564	8	1800	80	2476	43	2519	Gordon	446
648	512	6	2047	70	2705	35	3113	Gordon and Fifth	447
......	......	......	1990	70	2690	30	2926	————	448
......	......	......	1900	50	2591	48	2856	Fifth	449
......	......	......	......	......	......	......	......	Fifth	450
......	......	......	......	......	......	......	......	Fifth	451
152	1013	8	1567	103	2234	20	2538	Fifth	452
160	990	8	1600	75	2237	23	2520	Max., B. I. and 5th	453
......	......	......	......	......	......	......	......	5th	454
......	......	......	......	......	......	......	......	5th	455
582	610	8	1976	74	(2670)	16	2938	Gordon and 5th	456
......	......	......	......	......	......	......	......	Gordon	457
510	515	10	1900	75	2589	......	2665	B. I. and Gordon	458
716	479	6	2036	174	2808	......	3146	————	459
741	399	......	......	......	2790	20	3018	Gordon, 4th and 5th	460
......	......	......	......	......	......	......	2060	Max.	461
664	466	6	2052	85	2739	......	2760	Gordon	462
700	650	6	2130	88	2800	......	3028	5th	463
463	677	6	1870	72	2521	27	2791	5th	464

Summarized Record of Wells in

Map No	NAME OF WELL	Location—District	OWNER	Elevation A. T.
465	G. W. Albright No. 1	Ten Mile	South Penn	1350B
466	G. W. Albright No. 2	Ten Mile	South Penn	1310B
467	G. W. Albright No. 3	Ten Mile	South Penn	1350B
468	Sanford Nuzum No. 1	Ten Mile	South Penn	1105B
469	Dorothy Young No. 1	Ten Mile	Fearless	1145B
470	L. E. Stout No. 1	Ten Mile	Hope	......
471	Wm. Jarvis No. 1	Ten Mile	Hope	1030L
472	G. Payne No. 6	Ten Mile	South Penn	1050B
473	G. Payne No. 10	Ten Mile	South Penn	1069L
474	G. Payne No. 3	Ten Mile	South Penn	1260B
475	G. Payne No. 2	Ten Mile	South Penn	1150B
476	Leeman Maxwell No. 1	Ten Mile	Southern	1130B
477	S. Nutter No. 1	Ten Mile	Southern	1130L
478	L. E. Ash No. 159	Union	Reserve	1140B
479	M. W. Smith No. 1	Union	Reserve	1120B
480	Sanford Fleming No. 1	Union	Reserve	1200B
481	L. Lanham No. 1	Union	Reserve	1210B
482	F. M. Davis No. 1	Union	Reserve	1095B
483	Edw. Maxwell No. 1	Union	Reserve	1155B
484	W. B. Maxwell No. 2005	Union	Phila	1017L
485	Lee Maxwell No. 1	Union	Reserve	990B
486	Dr. E. E. Edgell No. 1	Union	Hope ?	980B
487	G. W. Wolf No. 1	Union	United States	1055B
488	Harvey Heffner No. 2038	Union	Phila	1175B
489	T. S. Wright No. 277	Union	Reserve	1045B
490	Wirt Post No. 1	Union	Reserve	1090B
491	W. W. Post No. 1	Union	Reserve	1075B
492	Earl Post No. 1	Union	Hope	1195B
493	Beckwith Bice No. 1	Union	Hope	1200B
494	Nancy Nicholson No. 1979	Union	Phila	1155B
495	I. C. Bennett No. 1	Union	Washington	1160B
496	W. B. Brown No. 1588	Union	Hope	1170B
497	Harriet Stutler No. 1	Union	Reserve	1020B
498	Jacob McConkey No. 1	Union	Hope	985B
499	W. S. Burnside No. 1	Union	Hood & White	1006L
500	W. S. Burnside No. 1	Union	Hope	1015L
501	Wm. Gaston No. 1	Union	Hope	1090B
502	Loretta Finley Heirs No. 1	Union	Crude	1335B
503	Chas. W. Rhodes No. 1	Union	Reserve	1020B
504	C. C. Tallman No. 1	Union	South Penn	994L
505	Austin Hardway No. 1	Union	Hope	1080B
506	Arthur Rhodes No. 2	Union	Hope	1000B
507	Stephen Bennett No. 2	Union	South Penn	1330B
508	Edith Starkey No. 1	Union	South Penn	1145B
509	L. J. Ayers No. 1	Union	South Penn	1410B
510	Abram Coffindaffer No. 2	Union	South Penn	1380B
511	Abram Coffindaffer No. 3	Union	South Penn	1140B
512	A. Mathey No. 3	Union	South Penn	1105L
513	F. M. Bailey No. 1	Union	South Penn	1135B

Harrison County.—Continued.

PITTSBURGH COAL			BIG INJUN SAND		GORDON SAND		Total Depth	PRODUCING SAND	Map No.
Depth (top)	Elevation (top) A. T	Thickness	Depth (top)	Thickness	Depth (top)	Thickness			
696	654	7	2135	65	2840	......	3039	Stray, Gord. and 5th....	465
695	615	7	2098	77	2784	31	3009	Stray and 5th...........	466
750	600	8	2190	50	2855	45	3061	5th	467
......	......	......	......	......	......	......	......	5th	468
640	505	......	2030	110	2723	32	2950	5th	469
325	745	......	1755	80	2425	......	2660	Stray and 5th...........	470
......	......	......	......	......	......	......	......	————	471
......	......	......	......	......	......	......	......	5th	472
......	......	......	......	......	......	......	......	5th	473
503	757	8	1958	47	2600	......	2839	Gordon	474
490	660	......	1900	......	2620	34	2909	————	475
650	480	......	......	......	2730	......	3050	5th	476
680	450	......	......	......	2765	......	2980	Gordon	477
......	......	......	1487	87	2220	10	......	Max. and Gordon.......	478
......	......	......	......	......	......	......	......	————	479
......	......	......	1435	120	2190	30	2618	30-ft. and 5th...........	480
......	......	......	......	......	......	......	......	30-ft	481
......	......	......	......	......	......	......	......	30-ft. and 5th...........	482
......	......	......	1400	110	2093	52	2342	30-ft. and 5th...........	483
......	......	......	1285	100	......	......	1825	B. I. and 30-ft...........	484
......	......	......	......	......	......	......	......	————	485
......	......	......	......	......	......	......	......	————	486
......	......	......	1300	200	......	......	2460	50-ft	487
......	......	......	1530	120	......	......	2439	————	488
......	......	......	1333	102	......	......	1683	B. I. and Gantz........,	489
......	......	......	......	......	......	......	......	————	490
......	......	......	......	......	......	......	......	————	491
......	......	......	......	......	......	......	......	————	492
179	1021	5	......	......	......	......	......	Max	493
230	925	5	1686	70	2310	44	2583	Gord. and 5th...........	494
220	940	6	1692	97	2315	74	2561	Gord. and 5th...........	495
137	1033	......	1696	104	2341	32	2513	Gantz, 50-ft. & 5th......	496
......	......	......	......	......	......	......	......	————	497
......	......	......	1332	43	......	......	2160	5th	498
......	......	......	......	......	......	......	......	50-ft.	499
......	......	......	1272	......	......	......	......	B. Lm..................	500
......	......	......	1669	80	2292	20	2429½	Gantz, Stray and 5th....	501
......	......	......	......	......	......	......	......	————	502
......	......	......	......	......	......	......	......	————	503
......	......	......	1545	90	2100	35	2385	————	504
......	......	......	......	......	......	......	......	————	505
......	......	......	1213	116	......	......	1538	Gantz	506
......	......	......	......	......	......	......	......	5th	507
332	813	......	1787	......	2430	20	2677	5th	508
755	655	6	2200	80	......	......	3056	Stray and 5th...........	509
685	695	5	2142	58	2795	40	3003	5th	510
458	682	5	1900	100	2550	45	2783	5th	511
487	618	5	1915	103	2575	35	2814	5th	512
645	490	7	......	......	2720	35	3018	————	513

Summarized Record of Wells in

Map No	NAME OF WELL	Location—District	OWNER	Elevation A. T.
514	A. Mathey No. 6	Union	South Penn	1345B
515	Stephen Myers No. 1	Union	South Penn	1255B
516	E. J. Marsh No. 1	Union	Hope	1225B
517	Walter S. Fairs No. 1	Union	South Penn	1120B
518	Frank C. Curry No. 1	Union	South Penn	1090B
519	Jos. M. Campbell No. 1	Union	Hope	1041L
520	Thos. J. McKinley No. 2	Union	South Penn	1135B
521	Thos. J. McKinley No. 1	Union	South Penn	1053L
522	J. M. Hall No. 1	Union	South Penn	1390B
523	Crocker-Hall No. 1	Union	Reserve	1065B
524	H. A. Hall No. 1	Union	South Penn	1075B
525	W. L. Hall No. 3	Union	South Penn	1050B
526	Rush Moffet No. (1)	Union	South Penn	1235B
527	Isaac Carder No. 2	Union	———	1275B
528	Henry Nutter No. 1	Union	———	1170B
529	Mollie Marts No. 1	Union	South Penn	1100B
530	Z. W. Morris No. 1	Union	———	1065B
531	Emily F. Coffindaffer No. 1	Union	Hope	1125B
532	H. S. Davis No. 1	Eagle	South Penn	1140B
533	Simon S. Shriver No. 2	Eagle	South Penn	1160B
534	(J. E. Copenhaver No. 1)?	Eagle	South Penn	(1160B)
535	Serena Wyer No. 1	Eagle	South Penn	1025B
536	Loretta Morris No. 1	Eagle	South Penn	1030B
537	(O. Hawker) I. Moore No. 1	Eagle	Carnegie	1065B
538	Nancy Rogers No. 2	Eagle	South Penn	1335B
539	Sarah Baker No. 1	Eagle	South Penn	1300L
540	Acena Copenhaver No. 1	Eagle	South Penn	1135B
541	C. L. Starkey No. 1	Eagle	South Penn	1105B
542	Enoch Starkey No. 2	Eagle	South Penn	......
543	H. S. Davis No. 1	Eagle	Carnegie	1270B
544	Dan'l F. Cunningham No. 1	Eagle	South Penn	1010B
545	W. P. Mason No. 1	Eagle	South Penn	1013L
546	W. P. Mason core test	Eagle	J. V. Thompson	1005L
547	A. P. Mason No. 1	Eagle	Burt	995B
548	John R. Mason No. 1	Eagle	Burt	985B
549	Isaac Hess No. 1	Eagle	Hope	985B
550	W. A. Rusk No. 1	Eagle	Carnegie	980B
551	B. F. Griffin No. 1	Eagle	Carnegie	......
552	Dan'l E. Shaw No. 1	Eagle	Carnegie	1285B
553	Ellsworth Ogden No. 1	Eagle	Hope	1150B
554	Thos. Hawker No. 1	Eagle	Hope	1010B
555	Odell V. Ashcraft No. 2117	Eagle	Phila	1170B
556	Chas. Ashcraft No. 1	Eagle	Hope	1360B
557	L. A. Martin No. 1	Eagle	Hope	1445B
558	Wm. Hardesty No. 1	Eagle	Phila	980B
559	Wm. Chalfant No. 1878	Eagle	Phila	1190L
560	Jas. A. Robinson No. 1	Eagle	South Penn	1050B
561	Geo. Coffman No. 1	Eagle	Hope?	1070B
562	Luther Coffman No. 1	Eagle	Hope	1210B

Harrison County.—Continued.

PITTSBURGH COAL			BIG INJUN SAND		GORDON SAND		Total Depth	PRODUCING SAND	Map No
Depth (top)	Elevation (top) A. T.	Thickness	Depth (top)	Thickness	Depth (top)	Thickness			
740	605	6	2225	55	......	......	2802	Stray	514
728	527	7	2170	110	2785	7	2787	Stray	515
......	......	......	......	......	......	......	......	Gord., Stray, 4th	516
......	......	......	1920	105	2520	68	2840	Stray	517
......	......	......	1780	120	2390	62	2650	————	518
......	......	......	......	......	......	......	......	Gord. and 5th	519
......	......	......	......	......	......	......	......	5th	520
......	......	......	......	......	......	......	......	5th	521
605	785	5	2095	125	2700	40	2922	5th, Stray, Gordon	522
......	......	......	1635	147	2218	92	2462	30-ft. and 5th	523
......	......	......	......	......	......	......	......	————	524
......	......	......	1752	96	2370	51	2576	5th	525
......	......	......	......	......	......	......	......	————	526
......	......	......	......	......	......	......	......	5th	527
......	......	......	......	......	......	......	......	Stray and 5th	528
......	......	......	1976	143	2557	26	2598	Gordon	529
......	......	......	......	......	......	......	......	B. I.	530
......	......	......	......	......	......	......	......	————	531
865	275	5	2150	109	2988	......	3012	Gordon	532
860	300	5	2125	115	2954	44	3026	Gordon	533
1080	(80)	5	2345	100	3160	28	3237	Gordon	534
595	430	6	1913	125	2742	40	2789	30-ft	535
......	......	......	1820	36	2691	19	3060	Stray	536
617	448	6	1918	142	......	......	2640	30-ft	537
924	411	6	2219	147	3049	6	3060	————	538
858	442	4	2170	145	2987	7	3290	Stray	539
750	385	5	......	......	......	......	1604	II Cow Run	540
770	335	6	2050	120	2876	39	3006	50-ft. and Gordon	541
1079	......	3	2363	117	3178	39	3230	Gordon	542
860	410	5	2230	......	......	......	2240	B. I.	543
782	228	5	2070	110	2866	100	3372	Gordon	544
......	......	......	......	......	......	......	......	————	545
......	......	......	......	......	......	......	......	————	546
......	......	......	......	......	......	......	......	————	547
250	745	......	1565	100	2418	16	2434	Gordon	548
175	810	......	......	......	......	......	......	————	549
......	......	......	......	......	......	......	......	————	550
485	......	10	1800	150	......	......	2491	50-ft. and 30-ft.	551
670	615	8	1961	135	2807	33	2986	B. I. and 50-ft.	552
......	......	......	1615	105	2423	27	2795	50-ft., 30-ft., 4th	553
......	......	......	......	......	......	......	......	————	554
280	890	8	1665	125	2470	15	2716	B. I. and 5th	555
......	......	......	......	......	......	......	......	————	556
......	......	......	......	......	......	......	......	————	557
......	......	......	......	......	......	......	......	————	558
......	......	......	......	......	......	......	......	B. I.	559
......	......	......	1324	44	......	......	1383	B. I.	560
......	......	......	......	......	......	......	......	————	561
......	......	......	......	......	......	......	......	————	562

Summarized Record of Wells in

Map No.	NAME OF WELL	Location—District	OWNER	Elevation A. T.
563	J. B. Cunningham No. 1	Eagle	Fairmont	1000B
564	James Coffman No. 1	Eagle	Phila	1085B
565	Harriet A. Michael No. 2342	Eagle	Phila	1160B
566	Lemuel Heldreth No. 1	Eagle	Carnegie	1180B
567	Sylvester Lyons No. 1	Eagle	Hope?	1070B
568	B. F. Heldreth No. 1	Eagle	Carnegie	1080B
569	J. A. Harbert No. 2142	Eagle	Phila	1025B
570	Effie M. Mason No. 1	Eagle	Hope	1190B
571	Jennie Martin No. 1	Eagle	Carnegie	1065B
572	B. F. Rogers No. 1788	Eagle	Phila	1005B
573	Ida M. Hustead No. 1	Eagle	Hope	1145B
574	J. Allen Swiger No. 1	Eagle	Wheeling	1050B
575	R. M. Rogers No. 2293	Eagle	Phila	1005B
576	H. N. Hustead No. 1	Eagle	Hope	1165B
577	E. L. Coffman No. 1	Eagle	Hope	930B
578	C. D. Robinson No. 2157	Eagle	Phila	1010B
579	F. L. Robey No. 1	Eagle	Carnegie	985B
580	E. L. Coffman No. 2362	Eagle	Phila	1195B
581	Lee Boggess No. 4	Eagle	Carnegie	1075B
582	Ellis Fortney No. 1	Eagle	Lumberport	975L
583	Fletcher Robinson No. 1	Eagle	Lumberport	985B
584	Thos. E. Harbert No. 1	Eagle	Hope	985B
585	M. E. and E. G. Denham No. 1	Eagle	Hope	1130L
586	Theodore Coffman No. 1	Eagle	Hope	1120L
587	Horner Hdw. Co. No. 1	Eagle	Lumberport	920B
588	Caroline Mathews No. 1	Eagle	Horner	930B
589	Ben Mathers No. 1	Eagle	Hope	1295B
590	Ellis Fortney No. 1	Eagle	Hope	1070B
591	J. H. Towles No. 1	Eagle	Haywood O. G.	990B
592	V. B. Ogden No. 1	Eagle	South Penn	935B
593	V. B. Ogden No. 2	Eagle	South Penn	965B
594	Curtis Ashcraft No. 1	Eagle	Lumberport	980B
595	Jas. Lyons Heirs No. 1	Eagle	Hope	1030B
596	Frank Reynolds No. 1	Eagle	Hope	1020B
597	Howard Gore No. 1	Eagle	O. C. Bradley	1265B
598	F. J. Drummond No. 1512	Eagle	Hope	1050B
599	Virginia B. Kile No. 1	Eagle	Hope	1191L
600	Lindsay Jett No. 1	Clay	Carnegie	1110B
601	Frank Booher No. 1	Clay	Hope	1145B
602	O. C. Martin No. 1	Clay	South Penn	1095B
603	Geo. W. Millan No. 1	Clay	Carnegie	1297L
604	Seymour Stark No. 1	Clay	Phila	1115B
604A	Lucas Bros. No. 1	Clay	Phila	935B
605	Chas. Short No. 1	Clay	———	1035B
605A	Lucas Bros. No. 4	Clay	Phila	900B
606	Morris Tegard No. 1	Clay	Hope	1363L
607	Hood Bros. No. 1	Clay	Hope	910B
608	B. W. Shinn No. 1	Clay	Hope	1040B
609	John F. Sturms Heirs No. 1	Clay	Carnegie	1055B

Harrison County.—Continued.

PITTSBURGH COAL			BIG INJUN SAND		GORDON SAND		Total Depth	PRODUCING SAND	Map No.
Depth (top)	Elevation (top) A. T.	Thickness	Depth (top)	Thickness	Depth (top)	Thickness			
(—10)	1010	......	1365	124	2189	11	2376	30-ft. and Gord..........	563
37	988	......	1516	42	......	......	2808	B. I., Berea and Fifth...	564
562	598	6	1898	......	......	......	2010	B. I....................	565
670	510	......	1997	146	2785	28	3172	————	566
......	......	......	......	......	......	......	......	————	567
340	740	5	1660	......	......	......	1695	B. I....................	568
185	840	7	1539	76	2283	17	......	B. I., 30-ft., Gord. & 5th.	569
......	......	......	......	......	......	......	......	————	570
118	947	6	1465	110	2220	55	2387	4th	571
......	......	......	1305	100	2106	24	2130	B. I. and Gord..........	572
......	......	......	......	......	......	......	......	————	573
25	1025	......	......	......	......	......	......	————	574
......	......	......	1382	100	......	......	2369	B. I. and 5th...........	575
20	1145	......	......	......	......	......	......	————	576
......	......	......	......	......	......	......	......	B. I. and Gord..........	577
......	......	......	1285	80	2082	27	2328½	B. I., Gord. and 5th.....	578
......	......	......	1304	104	2098	22	2422	B. I., 50-ft., 4th & 5th...	579
......	......	......	1467	68	......	......	2105	B. I., 30-ft. & Gord......	580
......	......	......	1315	85	2120	40	2332	B. I., 4th & 5th.........	581
(—93)	(1068)	......	1225	100	2070	20	2293	B. I., Gord. & 5th.......	582
......	......	......	1245	75	1995	55	2317	B. I., Gord., 50-ft. & 5th.	583
......	......	......	......	......	......	......	......	————	584
......	......	......	......	......	......	......	......	————	585
......	......	......	......	......	......	......	......	————	586
......	......	......	1310	85	2110	25	2278	Gord. and 5th...........	587
......	......	......	1348	112	2170	30	2358	B. I., Gord. & 5th......	588
......	......	......	......	......	......	......	......	B. I. and 4th............	589
......	......	......	......	......	......	......	......	————	590
......	......	......	......	......	......	......	......	————	591
......	......	......	1390	90	......	......	2265	4th	592
......	......	......	1405	100	2160	25	2265	————	593
......	......	......	......	......	2178	......	2217	————	594
......	......	......	......	......	......	......	......	————	595
......	......	......	......	......	......	......	......	————	596
208	1057	6	1621	109	2375	12	2478	4th	597
......	......	......	......	......	......	......	......	————	598
......	......	......	1570	115	2330	70	2409	30-ft. and 4th...........	599
......	......	......	......	......	......	......	......	B. I. and Gord..........	600
......	......	......	......	......	......	......	......	————	601
......	......	......	1675	45	2458	25	2559	4th	602
394	903	6	1814	106	2600	20	2832	5th	603
107	1008	11	1510	60	......	......	2561	50-ft. and 4th...........	604
......	......	......	1421	50	......	......	......	B. I....................	604A
......	......	......	......	......	......	......	......	————	605
......	......	......	1392	......	2120	......	......	50-ft., and 4th...........	605A
......	......	......	......	......	......	......	......	————	606
......	......	......	......	......	......	......	......	B. I....................	607
......	......	......	......	......	......	......	......	————	608
82	973	7	1506	......	......	......	1545	B. I....................	609

Summarized Record of Wells in

Map No.	NAME OF WELL	Location—District	OWNER	Elevation A. T.
610	G. L. Hardesty No. 7	Clay	Fisher & Phila	1085B
611	Stonewall McIntyre No. 1	Clay	South Penn	......
612	Alice Corpening No. 1	Clay	South Penn	995B
613	B. F. Anderson No. 2	Clay	South Penn	1125B
614	R. R. Hardesty No. 1	Clay	Hope	1170B
615	E. M. Sapp No. 1	Clay	South Penn	1165B
616	Isabel Robinson No. 1	Clay	————	985B
617	R. L. Reed and J. B. Cox No. 1	Clay	Benedum & Trees	......
618	E. E. Swiger No. 2316	Clay	Phila	1125B
619	E. J. Whiteman No. 2	Clay	South Penn	1090B
620	T. B. Martin No. 3	Clay	South Penn	1085B
621	S. L. Vincent No. 5	Clay	South Penn	1085B
622	A. W. Hartley Heirs No. 1	Clay	South Penn	1390B
623	A. W. Hartley Heirs No. 3	Clay	South Penn	1515B
624	E. W. Thompson No. 1	Clay	Blackstone	......
625	Wm. M. Gray No. 1	Clay	Run Smooth	1385B
626	Sam'l Southern No. 1	Clay	Tygart O. & G	1125B
627	J. R. Bartlett No. 1	Clay	South Penn	1156L
628	Dora (J. R.) Bartlett No. 1	Clay	South Penn	......
629	Geo. Rinehart No. 1	Clay	South Penn	1140B
630	Nimshi Nuzum No. 4	Clay	Miller & Co	1165B
631	Nimshi Nuzum No. 1	Clay	Miller & Co	1170B
632	Jos. Ashcraft No. 1	Clay	Phila	1115B
633	R. L. Reed No. 1	(Taylor Co.)	South Penn	954L
634	J. F. (Frank M.) Holt No. 1	(Taylor Co.)	Dugan et al	980B
635	Davis Heirs No. 1	(Marion Co.)	Fitch et al	1156L
636	H. E. Swiger No. 1	Clay	South Penn	1085B
637	Wm. Fancher No. 1	Clay	South Penn	1075B
638	J. L. Bice No. 1	(Marion Co.)	Gillespie et al	1020B
639	Geo. Martin (J. H. Willis) No. 1	(Taylor Co.)	————	1030B
640	Nettie Chalfant No. 1	Clay	South Penn	1110B
641	Rosa Radabaugh core test	Clay	T. N. Sands	1310B
642	G. W. Southern core test	Clay	T. N. Sands	......
643	Sam'l A. Elliott No. 1	Clay	South Penn	1030B
644	Abraham Righter No. 1	Clay	Righter et al	985B
645	L. D. Jarvis Heirs No. 1	Clay	Benedum & Trees	1095B
646	H. H. Bice No. 1	Clay	————	1160L
647	H. H. Bice core test	Clay	Consolidation	1080B
648	Silas Ogden No. 1	Clay	Mandell O. & G	1040B
648A	Luther Harbert No. 1	Clay	Phila	900B
649	Hugh Martin No. 1	Clay	Hope	920B
650	Emma Lyons No. 1	Coal	Hope	......
651	Boyd Allen No. 1	Coal	Hope	1190B
652	John Q. McIntyre No. 1	Coal	Hope	975B
653	Consolidation Coal Co. No. 1	Coal	Consolidation	1035B
654	Mordecai Smith No. 1	Coal	Hope	1105B
655	Moses Tichenall No. 1	Coal	Clarksburg	925B
655A	South & Cole No. 1	Coal	Penna. O. & G	......
656	Sam'l Williams No. 2	Coal	Hope	1145B

Harrison County.—Continued.

PITTSBURGH COAL			BIG INJUN SAND		GORDON SAND		Total Depth	PRODUCING SAND	Map No.
Depth (top)	Elevation (top) A. T.	Thickness	Depth (top)	Thickness	Depth (top)	Thickness			
..100	985	......	......	......	......	......	2069	50-ft	610
......	......	......	......	......	......	......	......	————	611
......	......	......	1439	104	2050	10	2506	Bayard?	612
......	......	......	......	......	......	......	......	50-ft	613
148	1022	9	1627	110	......	......	......	50-ft	614
......	......	......	1611	82	2215	35	2252	50-ft	615
......	......	......	......	......	......	......	......	————	616
......	......	......	......	......	......	......	......	————	617
60	1065	7	1545	153	......	......	......	50-ft	618
......	......	......	1510	120	......	......	2020	50-ft	619
......	......	......	......	......	......	......	......	————	620
......	......	......	1505	115	......	......	2064	50-ft	621
......	......	......	1825	150	2500	20	2828	————	622
440	1075	6	1910	100	......	......	2539	50-ft	623
170	......	10	1672	180	......	......	2258	B. I. and 50-ft	624
235	1150	7	1731	126	......	......	2310	B. I. and 50ft	625
......	......	......	......	......	......	......	......	————	626
......	......	......	......	......	......	......	......	————	627
135	......	......	1675	90	......	......	2205	50-ft	628
......	......	......	1480	125	......	......	2112	50-ft	629
40	1125	10	1554	106	......	......	2142	50-ft	630
60	1110B	......	1553	105	......	......	2164	50-ft	631
......	......	......	1510	170	2150	25	2175	50-ft	632
......	......	......	1670	110	......	......	2294	————	633
......	......	......	......	......	......	......	......	50-ft	634
......	......	......	......	......	......	......	......	————	635
......	......	......	1415	85	......	......	2074	50-ft	636
......	......	......	......	......	......	......	......	————	637
......	......	......	......	......	......	......	......	B. I., 50-ft. & 6th	638
......	......	......	......	......	......	......	(1300)	B. I.	639
......	......	......	1340	100	......	......	2860	50-ft	640
......	......	......	......	......	......	......	......	————	641
......	......	......	......	......	......	......	......	————	642
......	......	......	1400	96	2080	25	2672	Stray	643
......	......	......	......	......	......	......	745	————	644
......	......	......	......	......	......	......	......	————	645
......	......	......	......	......	......	......	......	————	646
169	911	10	......	......	......	......	......	————	647
115	825	5	1555	110	......	......	2697	B. I. and 6th	648
......	......	......	1357	75	2104	25	2353	B. I. and 5th	648A
......	......	......	......	......	......	......	......	————	649
......	......	......	......	......	......	......	......	5th	650
......	......	......	......	......	......	......	......	5th	651
......	......	......	1383	120	2112	13	2396	50-ft. and 5th	652
......	(1035)	......	......	......	......	......	......	————	653
40	1065B	......	......	......	......	......	......	————	654
......	......	......	1300	111	......	......	2305	B. I. and 5th	655
......	......	......	1355	110	......	......	2364	50-ft. and 5th	655A
......	......	......	1426	......	......	......	......	50-ft	656

Summarized Record of Wells in

Map No.	NAME OF WELL	Location—District	OWNER	Elevation A.T.
657	S. E. Hamrick No. 1145	Coal	Hope	1135B
658	T. F. Gifford No. 2102	Coal	Phila	1405B
659	J. W. Brown No. 1	Coal	Diamond	1025B
660	C. M. Long No. 1	Coal	Hope	1225B
661	Thos. Reynolds No. 1	Coal	Washington	1060B
662	D. C. Williams No. 120	Coal	Reserve	1025B
663	——— Pritchard No. 1	Coal	Penna. O. & G.	1080B
663A	——— Lyons No. 1	Coal	Penna. O. & G.	......
664	Consolidation Coal Co.	Coal	———	1075
665	R. W. Cooñ No. 1	Coal	Mandell O. & G.	985L
666	N. M. Talbott	Coal	Mandell O. & G.	1000B
667	Addison Bartlett No. 1	Coal	Thos. Gartlan	1025B
668	Dick Smith No. 1	Coal	Mandell O. & G.	950B
669	B. F. Reynolds No. 2	Clark	Reserve	1150B
670	Hattie Porter No. 1	Clark	Peerless	1050B
671	B. W. Brown No. 1	Clark	Reserve	990B
672	Harrison Carter No. 1	Clark	Reserve	1145B
673	Nathan Goff No. ( )	Clark	Nathan Goff	990B
674	Wm. Ashcraft No. 1	Clark	Phila	955B
675	Monticello Brick Co. No. 1	Clark	Fuel City	960L
676	John Cost No. 1	Clark	Graselli	1030B
677	Frank Long No. 1	Clark	Hope	......
678	W. G. Kester No. 1	Clark	Graselli	995B
679	Fair Ground Imp. Co. No. 1	Clark	Fair Ground	975B
680	Angeline Ash No. 1	Clark	Clarksburg	960B
681	Geo. E. Corpening No. 1	Clark	Geo. Corpening	1075B
682	Morgan R. Lodge No. 2	Simpson	South Penn	......
683	Morgan R. Lodge No. 1	Simpson	South Penn	990L
684	John Nuzum No. 1	Simpson	Hope	1110B
685	J. R. Stout No. 1	Simpson	Bridgeport	1160B
686	Jesse H. Willis No. 1	Simpson	Clarksburg Co.	1050B
687	Miss C. N. Johnson No. 1	Simpson	Bridgeport	......
688	Jesse H. Willis No. 3	Simpson	Bridgeport	988L
689	Bridgeport Saw. & P. M. No. 1	Simpson	Bridgeport	970B
690	J. B. Sandusky core test	Simpson	Payne & Brady	975B
691	W. Frank Stout No. 1	Simpson	Hope	1160B
692	J. M. Carr No. 1	Simpson	Clarksburg Co.	1055B
693	Benedum Heirs No. 1	Simpson	Reserve	(1040B)
694	Jas. Smith No. 1	Simpson	South Penn	1010L
695	Hampton Lang No. 1	Simpson	Hope	......
696	Strother Stout No. 1	Simpson	Hope	990B
697	Chas. J. Roy No. 1	Simpson	Hope	1010B
698	L. L. Long No. 1	Simpson	South Penn	1020B
698A	J. G. Bender No. 1	Simpson	Tri-State	1030B
699	Geo. Lancaster No. 1	Simpson	Hope	1365B
700	Beech Heirs No. 1	Grant	Hope	1010B
701	Claude Davisson No. 1	Grant	Weston G. Co.	996L
702	Lucius Davis No. 1	Grant	Mt. Clare Gas	1100B
703	Isaac Watson No. 1	Grant	———	1155B
704	Levi Paugh No. 1352	Grant	Hope	1176L

Harrison County.—Continued.

PITTSBURGH COAL			BIG INJUN SAND		GORDON SAND		Total Depth	PRODUCING SAND	Map No.
Depth (top)	Elevation (top) A. T.	Thickness	Depth (top)	Thickness	Depth (top)	Thickness			
5	1130	5	1419	111	......	......	2427	4th and 5th	657
251	1154	9	1670	105	......	......	2655	B. I., 50-ft. 30-ft. & 4th	658
......	......	......	......	......	......	......	......	——	659
......	......	......	1665	100	2378	47	2455	Gordon	660
......	......	......	1310	100	2002	18	2265	5th	661
......	......	......	......	......	......	......	......	——	662
......	......	......	......	......	......	......	......	——	663
25	......	8	1360	240	......	......	2034	B. I. and 50-ft	663A
......	......	......	......	......	......	......	2460	——	664
......	......	......	1460	110	2115	45	2523	6th	665
......	......	......	1480	105	2130	35	2517	6th	666
......	......	......	......	......	......	......	......	5th	667
......	......	......	1435	105	2120	25	2502	B. I., Gord. & 6th	668
......	......	......	......	......	......	......	......	——	669
......	......	......	1240	150	1943	15	2229	B. I.	670
......	......	......	1260	60	2022	20	2242	Gord. and 5th	671
......	......	......	......	......	......	......	......	——	672
......	......	......	......	......	......	......	......	——	673
......	......	......	......	......	......	......	......	——	674
......	......	......	......	......	......	......	......	——	675
......	......	......	1350	110	1980	25	2325	——	676
......	......	......	......	......	......	......	......	——	677
......	......	......	1447	78	......	......	2506	——	678
......	......	......	......	......	......	......	......	——	679
......	......	......	1420	105	2180	12	2389	B. I. Gnz. and 5th	680
......	......	......	......	......	......	......	......	——	681
......	......	......	1470	100	2065	25	2471	——	682
......	......	......	1340	65	1975	15	2520	50-ft.	683
......	......	......	1270	130	......	......	2540	——	684
......	......	......	1385	120	2087	8	2475	——	685
......	......	......	1285	......	......	......	2242	B. I.	686
......	......	......	1285	90	......	......	2310	Maxton	687
......	......	......	1187	113	......	......	2222	Salt, 50-ft. & 6th	688
......	......	......	1280	70	......	......	2222	6th	689
......	......	......	......	......	......	......	......	——	690
......	......	......	......	......	......	......	......	——	691
......	......	......	......	......	......	......	......	——	692
......	......	......	......	......	......	......	......	——	693
......	......	......	......	......	......	......	......	——	694
......	......	......	......	......	......	......	......	——	695
......	......	......	......	......	......	......	......	——	696
......	......	......	1371	54	......	......	1792	B. I. and 30-ft	697
......	......	......	1247	63	1895	15	2525	B. I.	698
......	......	......	1365	105	......	......	4028	——	698A
42	1323	6	......	......	......	......	3371	Dry Hole	699
......	......	......	......	......	......	......	......	——	700
......	......	......	1462	96	......	......	2400	5th	701
......	......	......	......	......	......	......	......	——	702
......	......	......	......	......	......	......	......	——	703
......	......	......	1410	95	......	......	2315	5th	704

Summarized Record of Wells in

Map No	NAME OF WELL	Location—District	OWNER	Elevation A. T.
705	Seven Day Baptist No. 1......	Grant..........	Lost Creek..........	1070L
706	Seven Day Baptist No. 1......	Grant..........	Penna. O. & G......	1020B
707	Chas. Post No. 1............	Grant..........	Hope	1055B
708	Ed Conley No. 1.............	Grant..........	Hope	1290B
708A	C. S. Gribble No. 1.........	Grant..........	Lost Creek..........	1145B
709	Levi Davis No. 1............	Grant..........	Hope	1095B
710	Adam Cookman No. 1........	Grant..........	Hope	1125B
711	I. C. Bishop No. 1...........	Grant..........	Hope	1170B
712	L. D. Blake No. 1............	Grant..........	Hope	1092L
713	Lloyd Stout No. 1...........	Grant..........	Hope	1222L
714	Burgett Swisher No. 1.......	Grant..........	Hope	1550B
715	Goff McWhorter No. 1........	Grant..........	Raven Carbon.......	1180B
716	John H. Hardway No. 1.......	Grant..........	Graselli	1080B
717	Reason Davisson (120A) No. 1.	Grant..........	Hope	1145B
717A	J. N. Rector No. 1...........	Grant..........	Tri-State	1155B
718	W. G. Kennedy No. 1.........	Grant..........	Tri-State	1185B
718A	S. J. Davisson No. 1.........	Grant..........	Tri-State	1330B
719	I. M. Swisher No. 1..........	Grant..........	Tri-State	1160B
720	Porter Maxwell No. 1982......	Grant..........	Phila.	1015B
721	Porter Maxwell No. 2039......	Grant..........	Phila.	1245
722	Enoch Gaston No. 1..........	Grant..........	Southern	1033L
723	J. F. Freeman No. 1..........	Grant..........	Hope	1255B
724	Wm. H. Horner No. 1.........	Grant..........	Hope	1335B
725	W. H. McWhorter No. 3......	Grant..........	Raven Carbon.......	1390B
726	S. Orlando Davis No. 1........	Grant..........	Hope	1080B
727	Bart Jackson No. 1..........	Grant..........	Hope	1090B
728	Mary J. Burnside No. 1.......	Grant..........	Wheeling	1025B
729	W. B. Reed No. 1...........	Grant..........	Reserve	1145B
730	A. A. Smith No. 1...........	Grant..........	South Penn.........	1010B
731	H. Burnside & Smith No. 1...	Grant..........	South Penn.........	......
732	Mary Price No. 1............	Grant..........	Vesper Gas.........	1130L
732A	Bassell Heirs No. 1..........	Grant..........	Tri-State	......
732B	Bassell Heirs No. 2..........	Grant..........	Tri-State	......
732C	L. B. Davisson No. 1.........	Grant..........	Tri-State	......
732D	L. M. Bassell No. 3..........	Grant..........	Tri-State	......
733	Frank White No. 1..........	Elk...........	Hope	1090B
734	H. Booth (Carr) No. 1........	Elk...........	————	1010L
735	Robt. Fox et al. No. 1........	Elk...........	Hope	......
736	Arthur Conley No. 1.........	Elk...........	Hope	1155L
737	A. H. Davisson No. 1........	Elk...........	Tri-State	1015B
738	E. W. Post No. 1............	Elk...........	Guffey & Galley.....	(1060)
739	L. Nathan Lewis No. 1........	Elk...........	South Penn?........	1080B
740	I. S. Reger No. 1............	(Upshur Co.)..	Hope	1080B
741	Foster No. 1................	(Upshur Co.)..	————	......

Harrison County.—Continued.

PITTSBURGH COAL			BIG INJUN SAND		GORDON SAND		Total Depth	PRODUCING SAND	Map No.
Depth (top)	Elevation (top A.T.	Thickness	Depth (top)	Thickness	Depth (top)	Thickness			
......	......	......	1260	140	1933	17	2193	B. I., Gnz. and 5th.......	705
......	......	......	1206	118	1928	11	2110	Berea and 5th............	706
......	......	......	......	......	......	......	......	————	707
......	......	......	......	......	......	......	......	————	708
......	......	......	1250	115	1915	5	2157	Gnz., 4th and 5th........	708A
......	......	......	......	......	......	......	......	————	709
......	......	......	1250	100	......	......	1545	Gnz.	710
......	......	......	......	......	......	......	......	————	711
......	......	......	1285	145	1985	23	2363	————	712
......	......	......	......	......	......	......	......	————	713
......	......	......	......	......	......	......	......	————	714
......	......	......	......	......	......	......	......	————	715
......	......	......	1300	100	......	......	1640	Berea	716
......	......	......	......	......	......	......	......	————	717
......	......	......	1385	122	......	......	1730	Berea	717A
......	......	......	1422	103	2173	13	2325	5th	718
26	1305	......	1595	80	2310	14	2494	Berea and 5th..........	718A
......	......	......	1370	120	2070	40	2342	5th	719
......	......	......	1405	205	2040	55	2452	4th and 5th.............	720
......	......	......	1560	120	2275	32	2495	5th	721
......	......	......	1340	70	2015	15	2225	5th	722
......	......	......	......	......	......	......	......	————	723
......	......	......	......	......	......	......	......	————	724
50	1340	4.5	1615	145	2352	......	2362	Berea and Gordon.......	725
......	......	......	......	......	......	......	......	————	726
......	......	......	......	......	......	......	......	————	727
......	......	......	1220	170	1927	35	2080	Max., 50-ft., Gord. & 5th.	728
......	......	......	......	......	......	......	......	————	729
......	......	......	......	......	......	......	......	————	730
......	......	......	1280	120	......	......	......	30-ft.	731
......	......	......	1440	115	2167	30	2347	B. I., Berea and 5th....	732
......	......	......	1285	100	......	......	1587	Berea	732A
......	......	......	1275	115	1970	25	2215	Berea	732B
......	......	......	1395	142	2100	15	3183	5th	732C
......	......	......	1300	121	......	......	2203½	B. I., Berea and 5th.....	732D
......	......	......	1400	100	......	......	2335	30-ft. and 5th...........	733
......	......	......	1275	......	1995	20	2257	B. I., Stray, 5th and 6th.	734
......	......	......	......	......	......	......	......	————	735
......	......	......	1225	90	......	......	2358	5th	736
......	......	......	1225	95	1937	27	3290	B. I.....................	737
......	......	......	1475	85	......	......	2481	————	738
......	......	......	......	......	......	......	......	————	739
......	......	......	1554	143	2220	25	2612½	Squaw	740
......	......	......	......	......	......	......	......	————	741

Under the column headed "Producing Sand," the following abbreviations are used:

I C. R	First Cow Run.
B. Dunk	Big Dunkard.
II C. R	Second Cow Run.
Max	Maxton.
B. Lm	Big Lime.
Knr	Keener.
Big I	Big Injun.
Berea	Berea Grit.
Gnz	Gantz.
50-ft	Fifty-foot.
30-ft	Thirty-foot.
Stray	Gordon Stray.
Gord	Gordon.
4th	Fourth.
5th	Fifth, or McDonald.
6th	Sixth, or Bayard.

As with Doddridge county, this table of wells is very convenient for ready reference for information as to the depth and thickness of the Pittsburgh coal, the Big Injun and Gordon sands, and the total depth of the well; but it is very important that the complete record of a number of these wells be published for the same reasons as given in the explanations accompanying the table of wells for Doddridge county, page 290. The serial number of the well is published not only in the table, but along with the heading when the complete record is given, and also on the economic geology map referred to above.

SARDIS DISTRICT.

Sardis District occupies the northwest corner of Harrison county, and its area is traversed in a northeast-southwest direction by the Robinson syncline and the Wolf Summit anticline, but by far the greater portion lies in the former basin. A glance at the structure map accompanying this report will show that the strata therein are much warped and disturbed, the elevation of the Pittsburgh coal varying from 100′ A. T. in the northwest corner of the district to 1200′ A. T., 0.8 mile southeast of Katys Lick. Hence, conditions are ideal from a structural standpoint for the accumulation of oil and gas into pools of commercial value. The Gordon Stray, Gordon, and Fifth sands are the main producing horizons, while the Moundsville, Big Dunkard, Big Injun, Fifty-foot and Fourth have produced to some extent.

Along the western border of the district, there occur 275 to 300 Gordon sand oil wells along the Robinson Basin and a short distance up the southeast slope of the latter fold. As in the eastern portions of McClellan, Grant, and Greenbrier districts, Doddridge county, the location of this Gordon sand oil pool is in entire harmony with the "anticlinal theory" of White et al., as the Gordon contains no water in this region.

The three following records from the head of Elk creek contain data of interest:

Geo. F. Wyvel No. 1 Well Record (318).

Located in Marion county, ⅛ mile northeast of Marion-Harrison-Wetzel corner.

(Elevation, 1460′ B-A. T.)	Thickness Feet.	Total. Feet.
Unrecorded	1348	1348
Coal, Pittsburgh	6	1354
Unrecorded	1256	2610
Big Injun sand	90	2700
Unrecorded	670	3370
Sand, Stray (Gordon Stray)	61	3431
Unrecorded	2	3433
Gordon sand (pay, 3415′), and unrecorded to bottom	29	3462

Mary Hall No. 2 Well Record (319).

Located in Sardis District, 0.9 mile northwest of Alliance. Authority, South Penn Oil Company.

(Elevation, 1360′ B-A. T.)	Thickness Feet	Total. Feet.
Unrecorded	1245	1245
Coal, Pittsburgh	6	1251
Unrecorded	1099	2350
Big Lime	60	2410
Big Injun sand	98	2508

	Thickness. Feet.	Total. Feet.
Unrecorded	733	3241
Stray sand	59	3300
Unrecorded	18	3318
Gordon sand (oil pay, 3289′ and 3331′)	15	3333
Unrecorded to bottom	26	3359

O. E. Heldreth No. 2 Well Record (320).

Located in Sardis District, ½ mile northwest of Alliance. Authority, South Penn Oil Company.

	Thickness Feet.	Total. Feet.
Unrecorded	1060	1060
Coal, Pittsburgh	5	1065
Unrecorded	1221	2286
Big Lime	54	2340
Big Injun sand	90	2430
Unrecorded	626	3056
Stray sand	65	3121
Unrecorded	15	3136
Gordon sand (pay, 3153′)	29	3165
Unrecorded to bottom	1	3166

The following is the record of a well located 0.3 mile southwest of Heldreth No. 2 well (320), that probably starts at the highest elevation of any in the county:

E. L. Piggott No. 1 well Record (321).

Located in Sardis District, ¾ mile northwest of Alliance. Authority, Southern Oil Company.

(Elevation, 1590′ B-A. T.)	Thickness Feet.	Total. Feet.
Unrecorded	1498	1498
Coal, Pittsburgh, and unrecorded	2019	3517
Stray sand (oil, 3525′—3533′) and unrecorded	37	3554
Gordon sand (no oil)	10	3564
Unrecorded to bottom	23	3587

10″ casing, 300′; 8¼″ casing, 1913′; 6⅝″ casing, 2720′; 5$\frac{3}{16}$″ casing, 2940′.

"Shot in Stray sand, 3520′."

The above well is the deepest to the Pittsburgh coal of any other ever reported to the Survey in the State, and a portion of its record is used in connection with the Alliance section, page 141. The oil horizon is in the Gordon Stray and not the Gordon.

The records of the two following wells are given in brief in the table of wells for Harrison county, and their complete logs are published on the pages indicated of Vol. I(A) of the State Survey reports:

Map No.	Name of Well.	Location	Page of Vol. I(A)
322	E. T. Bennett No. 1.....	0.1 mile S. W. of Alliance..	306
323	Mary E. Heldreth No. 1..	0.2 mile S. of Alliance.....	306

Both report the oil pay in the Gordon sand, and the latter had an initial production of 50 barrels daily.

The following is the record of a well that has penetrated the Fifth sand, the latter being only 5 feet thick, 275 feet below the Gordon sand:

Alva Robinson No. 1 Well Record (326).

Located in Sardis District, 1 mile south of Alliance. Authority, South Penn Oil Company.

	Thickness Feet.	Total. Feet.
Unrecorded	830	830
Coal, Pittsburgh, and unrecorded	1230	2030
Big Lime	80	2110
Big Injun sand	90	2200
Unrecorded	703	2903
Gordon sand (oil)	27	2930
Unrecorded	15	2945
Fourth sand and unrecorded	260	3205
Fifth sand	5	3210
Unrecorded to bottom	22	3232

The following is the record of a shallow sand well:

(Thos. J.) Malissa Kelley No. 1 Well Record (328).

Located in Sardis District, 1.4 miles southeast of Alliance. Authority, South Penn Oil Company.

(Elevation, 1275' B-A. T.)	Thickness Feet.	Total. Feet.
Unrecorded	930	930
Coal, Pittsburgh, and unrecorded	352	1282
Sand, Little Dunkard? (Moundsville) (oil pay, 1287')	38	1320
Unrecorded to Big Dunkard sand	95	1415
(Bottom of hole.)		

Conductor, 16'; 10" casing, 196'; 8¼" casing, 1286'.

The well had an initial production from a sand that correlates with Moundsville (Saltsburg) and not the Little Dunkard as given by the driller.

The following is the record of a well located near the northwest edge of the Gordon sand oil pool on a west branch of Elk creek. Although a showing of gas is reported in the Stray, and of oil in the Gordon, yet the well was abandoned as a dry hole:

Jesse Talkington No. 1 Well Record (332).

Located in Sardis District, 1.1 miles S. W. of Alliance. Authority, South Penn Oil Company.

(Elevation, 1075′ B-A. T.)	Thickness Feet.	Total. Feet.
Unrecorded	1172	1172
Coal, Pittsburgh	5	1177
Unrecorded	487	1664
Sand, Dunkard (Little Dunkard)	20	1684
Unrecorded	216	1900
Sand, Salt? ("Gas")	65	1965
Unrecorded	405	2370
Big Lime	60	2430
Big Injun sand	130	2560
Unrecorded	455	3015
Fifty-foot sand	35	3050
Unrecorded	70	3120
Thirty-foot sand	20	3140
Unrecorded	44	3184
Stray (gas, 3229′)	61	3245
Unrecorded	15	3260
Gordon sand (oil, 3268′ and 3288′)	30	3290
Unrecorded to bottom	18	3308

Conductor, 14′; 10″ casing, 392′; 8¼″ casing, 1780′; 6⅝″ casing, 2570′.

The seven following records are from wells located near the axis of the Robinson Basin, on the head of Middle run:

Acena Talkington No. 2 Well Record (333).

Located in Sardis District, 1.4 miles N. 80° W. of Alliance. Authority, South Penn Oil Company. Completed Nov. 2, 1902.

	Thickness Feet.	Total. Feet.
Unrecorded	1155	1155
Coal, Pittsburgh	3	1158
Unrecorded	1267	2425
Big Injun sand	120	2545
Unrecorded	555	3100

	Thickness. Feet.	Total. Feet.
Thirty-foot sand (gas, 3110′)	25	3125
Unrecorded	35	3160
Stray sand (oil, 3185′ and 3205′)	60	3220
Unrecorded	20	3240
Gordon sand	16	3256

In the above well the Gordon sand is apparently dry, but oil was encountered in the Stray and gas in the Thirty-foot. This well had the largest initial oil production—2400 barrels daily—of any other well in the field, and was still making in August, 1910, 7 barrels daily, although 7 years old.

W. R. G. Hall No. 5 Well Record (334).

Located in Sardis District, 1.5 miles S. 80° W. of Alliance. Authority, South Penn Oil Company. Completed Feb. 29, 1904.

(Elevation, 1220′ B-A. T.)	Thickness Feet.	Total. Feet.
Unrecorded	1085	1085
Coal, Pittsburgh	3	1088
Unrecorded	1187	2275
Big Injun sand (water, 2380′)	170	2445
Unrecorded	705	3150
Gordon sand (oil, 3153′—3168′ and unrecorded to bottom	90	3240

John Stout No. 2 Well Record (335).

Located in Sardis District, 1.6 miles N. 20° E. of Rinehart. Authority, South Penn Oil Company.

(Elevation, 1115′ B-A. T.)	Thickness Feet.	Total. Feet.
Unrecorded	675	675
Sand, Bluff? (Carroll)	15	690
Unrecorded	290	980
Coal, Pittsburgh	5	985
Unrecorded	1255	2240
Big Injun sand	110	2350
Unrecorded	630	2980
Stray sand (gas, 3010′)	60	3040
Unrecorded	7	3047
Gordon sand (oil, 3053′)	19	3066
Unrecorded to bottom	4	3070

O. E. Hall No. 1 Well Record (336).

Located in Sardis District, 1.5 miles N. 15° E. of Rinehart. Authority, South Penn Oil Company. Completed Sept. 4, 1901.

(Elevation, 1125′ B-A. T.)	Thickness Feet.	Total. Feet.
Unrecorded	975	975
Coal, Pittsburgh	5	980

	Thickness. Feet.	Total. Feet.
Unrecorded	510	1490
Big Dunkard sand	30	1520
Unrecorded	370	1890
Sand, salt	18	1908
Unrecorded	67	1975
Sand, Maxton? (Salt)	25	2000
Unrecorded	160	2160
Pencil cave	5	2165
Big Lime	50	2215
Big Injun sand (gas and water, 2240')	110	2325
Unrecorded	480	2805
Fifty-foot sand	20	2825
Unrecorded	73	2898
Sand, Boulder (30-ft.)	25	2923
Unrecorded	27	2950
Stray sand (gas, 2993')	79	3029
Unrecorded	17	3046
Gordon sand (oil, 3050')	20	3066
Slate to bottom	114	3180

The name "Boulder" is frequently applied by the drillers to the Thirty-foot sand.

S. A. Cavalier No. 4 Well Record (337).

Located in Sardis District, 1¾ miles N. 25° E. of Rinehart. Authority, South Penn Oil Company. Completed Dec. 23, 1905.

(Elevation, 1150' B-A. T.)	Thickness Feet.	Total. Feet.
Unrecorded	1010	1010
Coal, Pittsburgh, (steel line)	3	1013
Unrecorded	372	1385
Sand, Little Dunkard? (Moundsville)	15	1400
Unrecorded	80	1480
Sand, Big Dunkard	20	1500
Unrecorded	180	1680
Gas sand	40	1720
Unrecorded	460	2180
Little lime	25	2205
Pencil cave	5	2210
Big Lime	55	2265
Big Injun sand	120	2385
Unrecorded	455	2840
Fifty-foot sand	30	2870
Unrecorded	120	2990
Stray sand	64	3054
Unrecorded	11	3065
Gordon sand (oil, 3070') and unrecorded to bottom	26	3091

Conductor, 16'; 10" casing, 220'; 8¼" casing, 1494'; 6⅝" casing, 2418'.

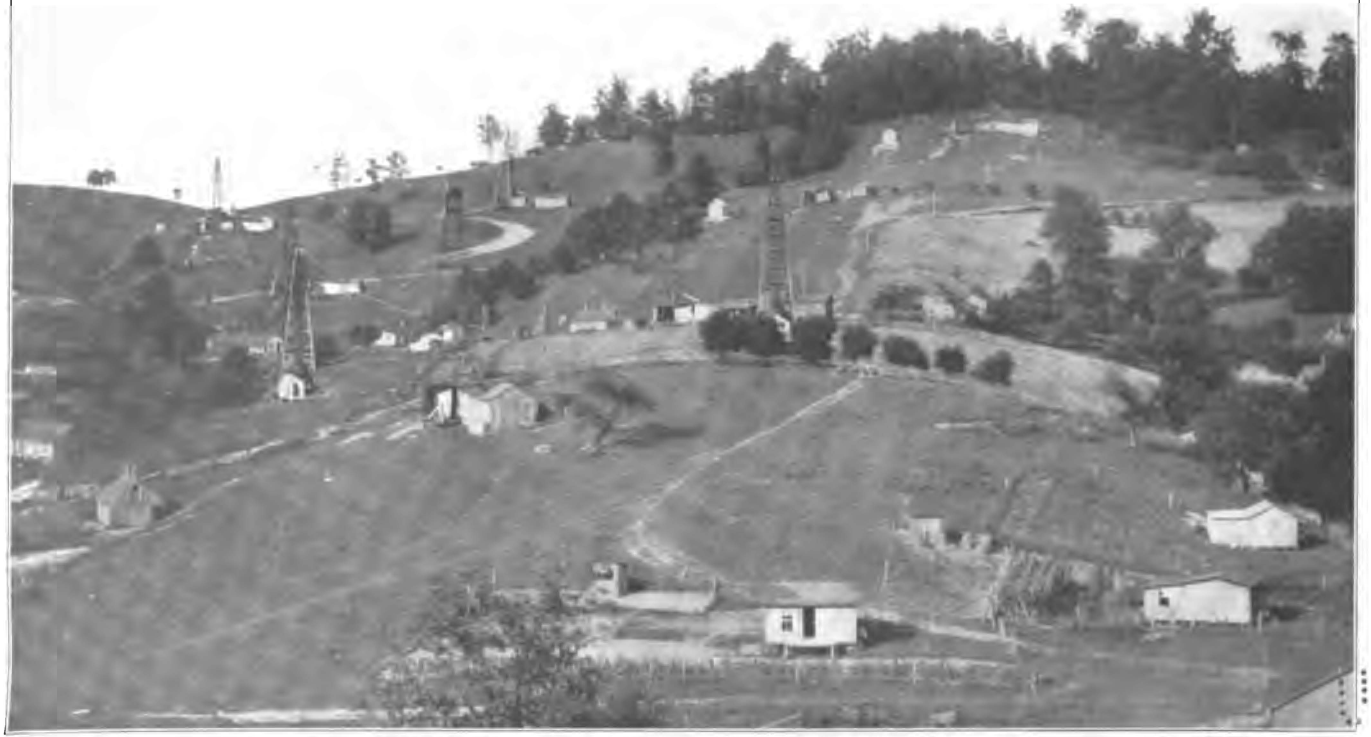


PLATE XII.—View of the Shinnston Oil Field on a branch of Mudlick run, and the Topography of the Monongahela series.

This well had an initial oil production of 200 barrels daily from the Gordon sand, and in August, 1910, still was making 2½ barrels daily.

O. E. Hall No. 3 Well Record (338).

Located in Sardis District, 1.1 miles north of Rinehart. Authority, South Penn Oil Company. Completed Nov. 25, 1903.

	Thickness Feet.	Total. Feet.
Unrecorded	1280	1280
Coal, Pittsburgh	7	1287
Unrecorded	1191	2478
Big Injun sand	42	2520
Unrecorded	800	3320
Stray sand, (gas, 3325')	22	3342
Unrecorded	16	3358
Gordon sand (oil, 3367')	19	3377
Unrecorded to bottom	1	3378

"15 barrels daily from Gordon sand."

G. W. Talkington No. 11 Well Record (339).

Located in Sardis District, 1 mile N. E. of Rinehart. Authority, South Penn Oil Company. Completed Sept, 2, 1904.

(Elevation, 1125' B-A. T.	Thickness Feet.	Total. Feet.
Unrecorded	950	950
Coal, Pittsburgh	5	955
Unrecorded	345	1340
Sand, Little Dunkard? (Moundsville)	30	1370
Unrecorded	70	1440
Sand, Big Dunkard? (I Cow Run)	10	1450
Unrecorded	455	1905
Salt sand	95	2000
Unrecorded	40	2040
Little lime	145	2185
Pencil cave	5	2190
Big Lime	50	2240
Big Injun sand	150	2390
Unrecorded	410	2800
Fifty-foot sand	30	2830
Unrecorded	60	2890
Thirty-foot sand	35	2925
Unrecorded	35	2960
Stray sand	30	2990
Unrecorded	15	3005
Gordon sand (oil pay, 3019')	29	3034
Unrecorded to bottom	57	3091

Conductor, 16'; 10" casing, 406'; 8¼" casing, 1580'; 6⅝" casing, 2185'; 5 3/16" casing, 2438'.

The records of the four following wells are given not only in brief in the table of well records for Harrison county, page 408, but in detail on the pages indicated below of Vol. I(A) of the State Survey reports:

Map No.	Name of Well.	Location	Page of Vol. I(A)
342	L. E. Bennett No. 1......	1 mile N. of Wallace......	307
353	Felix Coffman No. 1......	2 miles S. W. of Rinehart..	311
355	T. C. Bennett No. 3......	2 miles S. W. of Wallace..	313
357	T. C. Bennett No 1......	2.3 miles S. W. of Wallace.	312

Bartlett No. 1 (342) had a gas and oil show in the top of the Big Injun in addition to its Gordon sand oil production. It also had an oil showing at 2510 feet in the Berea sand, and not the Gantz as given in the record.

Coffman No. 1 (353) was a fine gasser in the Stray, since it is located some distance west of the axis of the Robinson Basin on the east slope of the Arches Fork anticline. It is also an oil producer in the Gordon sand.

Bennett No. 3 (355) is a gasser in the Fifty-foot and an oil producer in the Gordon; and No. 1 (357) is a Gordon oil well.

The five following records are from wells in the vicinity of Wallace and Rinehart northwestward across the Robinson Basin:

Wesley Robinson No. 5 Well Record (343).

Located in Sardis District, 0.6 mile north of Wallace. Authority, South Penn Oil Company. Well completed June 9, 1904.

(Elevation, 1080' B-A. T.	Thickness Feet.	Total. Feet.
Unrecorded	790	790
Coal, Pittsburgh	5	795
Unrecorded	480	1275
Sand, Big Dunkard	50	1325
Unrecorded	385	1710
Salt sand (water, 1770')	70	1780
Unrecorded	195	1975
Little lime	80	2055
Pencil cave	10	2065
Big Lime	40	2105
Big Injun sand (gas, 2106')	105	2210
Unrecorded	438	2648
Fifty-foot sand	40	2688
Unrecorded	57	2745

	Thickness. Feet.	Total. Feet.
Sand, Boulder (Thirty-foot)	40	2785
Unrecorded	15	2800
Stray sand	60	2860
Unrecorded	15	2875
Gordon sand (oil, 2891′ and 2906′)	45	2920
Unrecorded to bottom	5	2925

Conductor, 16′; 10″ casing, 224′; 8¼″ casing, 1659′; 6⅝″ casing, 1966′; 5$\frac{3}{16}$″ casing, 2440′.

S. N. Parrish No. 2 Well Record (344).

Located in Sardis District, ⅛ mile north of Wallace. Authority, South Penn Oil Company. Completed May 25, 1904.

(Elevation, 1040′ B-A. T.)	Thickness Feet.	Total. Feet.
Unrecorded	753	753
Coal, Pittsburgh (steel line)	7	760
Unrecorded	340	1100
Sand, Little Dunkard? (Moundsville and I Cow Run)	168	1268
Unrecorded	422	1690
Salt sand	20	1710
Unrecorded	158	1868
Maxton sand	70	1938
Unrecorded	10	1948
Pencil cave	8	1956
Big Lime	55	2011
Big Injun sand	131	2142
Unrecorded	438	2580
Fifty-foot sand	60	2640
Unrecorded	92	2732
Sand, Boulder (Thirty-foot)	20	2752
Unrecorded	14	2766
Stray sand	37	2803
Unrecorded	12	2815
Gordon sand (oil pay, 2830′)	42	2857
Unrecorded to bottom	45	2902

Conductor, 16′; 10″ casing. 224′; 8¼″ casing, 1320′; 6⅝″ casing, 2163′.

Woodfield-Sprout No. 1 Well Record (347).

Located in Sardis District, ⅛ mile southeast of Rinehart. Authority, South Penn Oil Company.

(Elevation, 1100′ B-A. T.)	Thickness Feet.	Total. Feet.
Unrecorded	900	900
Coal, Pittsburgh	4	904
Unrecorded	1236	2140
Big Lime	40	2180
Unrecorded	735	2915
Stray sand (gas, 2941′) and unrecorded	50	2965
Gordon sand (oil, 2972′ and 2977′)	23	2988
Unrecorded to bottom	40	3028

O. S. Ritter No. 1 Well Record (348).

Located in Sardis District, ⅛ mile east of Rinehart. Authority, South Penn Oil Company.

	Thickness. Feet.	Total. Feet.
Unrecorded	310	310
Coal, Washington, and unrecorded	525	835
Coal, Pittsburgh	10	845
Unrecorded	1264	2109
Big Injun sand (gas, 2109')	86	2195
Unrecorded	696	2891
Stray sand and unrecorded	41	2932
Gordon sand (oil)	30	2962
Unrecorded to bottom	13	2975

This well gives the Washington-Pittsburgh coal interval as 525 feet.

Bates-Harbert No. 1 Well Record (349).

Located in Sardis District, at Rinehart. Authority, South Penn Oil Company.

(Elevation, 1041' L-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	850	850
Coal, Pittsburgh	5	855
Unrecorded	1200	2055
Big Lime	55	2110
Big Injun sand	100	2210
Unrecorded	525	2835
Stray sand	72	2907
Unrecorded	18	2925
Gordon sand	21	2946
Unrecorded	15	2961
Fourth sand	6	2967
Unrecorded to bottom	10	2977

The two following records are of wells located on the east slope of the Arches Fork anticline on Mudlick run :

John Hearld No. 1 Well Record (351).

Located in Sardis District, ¾ mile west of Rinehart. Authority, Wheeling Natural Gas Company.

(Elevation, 1110' L-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	860	860
Coal, Pittsburgh	8	868
Unrecorded	482	1350
Dunkard sand (Big Dunkard)	30	1380

	Thickness. Feet.	Total. Feet.
Unrecorded	130	1510
Sand, "Gas", ("Gas" and II Cow Run) (water at 1618′)	180	1690
Unrecorded	60	1750
Salt sand	110	1860
Unrecorded	60	1920
Sand, Maxton? (Salt)	5	1925
Unrecorded	149	2074
Little lime	15	2089
Unrecorded	5	2094
Big Lime	56	2150
Big Injun sand (small gas flow, 2180′)	83	2233
Unrecorded	507	2740
Fifty-foot sand	20	2760
Unrecorded	60	2820
Thirty-foot sand	40	2860
Unrecorded	10	2870
Sand, Boulder(?) ...34′ Unrecorded .... 2 **Sand, Stray**.........29 (Gordon Stray)	65	2935
Gordon sand to bottom	20	2955

In this region the Gordon Stray ranges from 50 to 75 feet thick, but in this well it appears to be split by 2 feet of unrecorded interval, probably slate.

B. L. Rogers No. 2 Well Record (352).

Located in Sardis District, 1¼ miles west of Rinehart. Authority, Wheeling Natural Gas Company.

	Thickness. Feet.	Total. Feet.
Unrecorded	920	920
Coal, Pittsburgh	6	926
Unrecorded	374	1300
Little Dunkard sand	55	1355
Unrecorded	10	1365
Big Dunkard sand, soft and white (oil show, 1375′)	70	1435
Unrecorded	185	1620
Gas sand	25	1645
Unrecorded	55	1700
Sand, Salt? (II Cow Run)	30	1730
Unrecorded	218	1948
Second Salt sand	60	2008
Unrecorded	92	2100
Little lime	10	2110
Pencil cave	5	2115
Big Lime, (Big Injun sand, 103′ thick; gas, 2230′; light show of oil, 2240′) and unrecorded	340	2455
Sand, Thirty-foot? (Squaw), hard and white	30	2485
Unrecorded (first gas, 2776′)	294	2779
Fifty-foot sand, hard and white	40	2819
Unrecorded	66	2885

	Thickness. Feet.	Total. Feet.
Sand, Boulder (Thirty-foot)	30	2915
Unrecorded	20	2935
Stray sand (break, 2965'; gas, 2976')	62	2997
Unrecorded	10	3007
Gordon sand (gas, 3011', 3023')	22	3029
Unrecorded to bottom	5	3034

The first oil well in the Wallace field is said to be the E. D. Orr No. 1 well (354), located on Barnes run, ½ mile southwest of Wallace.

Southwestward along the axis of the Robinson Basin to the Harrison-Doddridge county line and eastward down Rockcamp run, there occur several Gordon sand oil wells. The six following records are from wells in this region:

Z L. McIntyre No. 1 Well Record (356).

Located in Sardis District, 2 miles southwest of Wallace. Authority, South Penn Oil Company.

(Elevation, 1150' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	930	930
Coal, Pittsburgh	9	939
Unrecorded	1193	2132
Big Lime	52	2180
Big Injun sand	120	2300
Unrecorded	698	2998
Stray sand (pay, 3002')	18	3016
Unrecorded	10	3026
Gordon sand (pay, 3052')	(34)	3060
Unrecorded to bottom	6	3066

G. W. Talkington No. 1 Well Record (359).

Located in Sardis District, ¾ mile S. 80° W. of Fonda. Authority, South Penn Oil Company.

(Elevation, 1165' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1440	1440
Sand, Little Dunkard (I Cow Run)	25	1465
Unrecorded	60	1525
Big Dunkard sand	75	1600
Unrecorded	179	1779
Gas sand	60	1839
Unrecorded	136	1975
Salt sand	50	2025
Unrecorded	261	2286
Big Lime	48	2334
Big Injun sand	40	2474

		Thickness. Feet.	Total. Feet.
Unrecorded		354	2790
Sand, Gantz? (Berea)		30	2820
Unrecorded		94	2914
Fifty-foot sand		40	2954
Unrecorded		66	3020
Sand, Boulder (30-ft.)		30	3050
Unrecorded		50	3100
Stray sand		25	3125
Unrecorded		14	3139
Gordon sand (oil, 3151')	**Gordon**	28	3167
Slate		11	3178
Sand (oil, 3178')		8	3186
Slate to bottom		35	3221

F. M. Gifford No. 1 Well Record (360).

Located in Sardis District, ¼ mile south of Fonda. Authority, Benedum-Trees Oil Company. Completed July 28, 1907.

(Elevation, 1065' B-A. T.)

	Thickness. Feet.	Total. Feet.
Unrecorded	830	830
Pittsburgh coal and unrecorded	380	1210
Sand, Little Dunkard? (I Cow Run)	35	1245
Unrecorded	70	1315
Big Dunkard sand	75	1390
Unrecorded	140	1530
Gas sand	25	1555
Unrecorded	20	1575
Sand, Salt? (II Cow Run)	45	1610
Unrecorded	200	1810
Maxton sand (water, 1968')	220	2030
Unrecorded	50	2080
Big Lime	45	2125
Big Injun sand (water, 2150')	140	2245
Unrecorded	455	2700
Fifty-foot sand (gas, 2702', 2734')	40	2740
Unrecorded	50	2790
Thirty-foot sand	20	2810
Unrecorded	16	2826
Stray sand	60	2886
Unrecorded	16	2902
Gordon sand (oil pay, 2912') and unrecorded to bottom.	20	2922

Nathan Goff No. 39 Well Record (361).

Located in Sardis District, 0.9 mile southwest of Fonda. Authority, B. M. Despard. Completed July 21, 1905.

(Elevation, 1053' L-A. T.)

	Thickness. Feet.	Total. Feet.
Unrecorded	826½	826½
Pittsburgh coal and unrecorded	398½	1225
Sand, Little Dunkard (I Cow Run)	15	1240
Unrecorded	55	1295

	Thickness. Feet.	Total. Feet.
Big Dunkard sand	20	1315
Unrecorded	285	1595
Sand, "Gas"? (II Cow Run)	35	1630
Unrecorded	105	1735
Salt sand	55	1790
Unrecorded	205	1995
Maxton sand	35	2030
Unrecorded	10	2040
Little lime	15	2055
Pencil cave	8	2063
Big Lime	81	2144
Big Injun sand	92	2236
Unrecorded	457	2693
Fifty-foot sand	40	2733
Unrecorded	62	2795
Thirty-foot sand	33	2828
Unrecorded	40	2868
Stray sand	15	2903
Unrecorded	15	2918
Gordon sand (first oil pay, 2926'; second oil pay, 2934') to bottom	22	2940

Conductor, 15'; 10" casing, 218'; 8¼" casing, 1312'; 6⅝" casing, 2400'; $5\frac{3}{16}$" casing, 2868'.

The log of the Nathan Goff No. 45 well (363) is used in connection with the Fonda section, page 92.

E. R. McIntyre No. 2 Well Record (363).

Located in Sardis District, 1¼ miles southeast of Fonda. Authority, Benedum-Trees Oil Company. Completed June, 1906.

(Elevation, 1020' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	700	700
Pittsburgh coal and unrecorded	332	1032
Sand, Little Dunkard? (Moundsville and I Cow Run)	114	1146
Unrecorded	38	1184
Big Dunkard sand	40	1224
Unrecorded	226	1450
Gas sand	40	1490
Unrecorded	90	1580
Salt sand	170	1750
Unrecorded	60	1810
Maxton sand	25	1835
Unrecorded	70	1905
Little lime	20	1925
Unrecorded	37	1962
Big Lime	48	2010
Big Injun sand	96	2106
Unrecorded	454	2560
Fifty-foot sand	20	2580
Unrecorded	75	2655
Thirty-foot sand	25	2680

	Thickness. Feet.	Total. Feet.
Unrecorded	50	2730
Gordon Stray sand	25	2755
Unrecorded	20	2775
Gordon sand (break, 2798′; oil, 2791′-2803′) and unrecorded to bottom	36	2811

M. K. Davisson No. 1840 Well Record (364).

Located in Sardis District, 1 mile southeast of Fonda. Authority, Philadelphia Company. Completed Aug. 12, 1905.

(Elevation, 1065′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	747	747
Coal, Pittsburgh	9	756
Unrecorded	396	1152
Sand, Little Dunkard (I Cow Run)	38	1190
Unrecorded	57	1247
Big Dunkard sand	5	1252
Unrecorded	73	1325
Sand, "Gas"? (Burning Springs)	63	1388
Unrecorded	117	1505
Sand, Salt? (Gas and II Cow Run)	80	1585
Unrecorded	30	1615
Salt sand	35	1650
Unrecorded	35	1685
Salt sand	35	1720
Unrecorded	104	1824
Maxton sand	108	1932
Unrecorded	28	1960
Big Lime	82	2042
Big Injun sand	113	2155
Unrecorded	459	2614
Fifty-foot sand (gas)	40	2654
Unrecorded	57	2711
Thirty-foot sand	25	2736
Unrecorded	44	2780
Gordon Stray sand	40	2820
Unrecorded	14	2834
Gordon sand (oil, 2839′-2847′)	41	2875
Unrecorded	1	2876
Fourth sand	10	2886
Unrecorded	149	3035
Fifth sand	3	3038
Unrecorded to bottom	109	3147

10″ casing, 248′; 8¼″ casing, 1182′; 6⅝″ casing, 2173′; 3″ casing, 2650′.

Gas pressure to the sq. inch in 50-ft. sand (6⅝″? casing):

1st minute, 50 lbs. 10th minute, 210 lbs.
5th minute, 105 lbs. 40th minute, 475 lbs.
Rock pressure, 520 lbs.

The records of the two following wells on Rockcamp run are published in brief in the table of wells for Harrison county, page 408, and in detail on the pages indicated of Vol. I(A) of the State Survey:

Map No.	Name of Well.	Location.	Page of Vol. I(A).
365	W. A. Rogers No. 2....	2.3 miles N. 80° W. of Olive...	310
367	Marshall Bailey No. 1..	0.3 mile N. of Olive...........	310

The major portion of the southeast half of Sardis district lies on the steep western slope of the Wolf Summit anticline, and on it in this region a large number of gas wells have been drilled.

On the head of Little Elk creek, Roland & Groves drilled the Benjamin Heldreth No. 1 well (330), in June, 1910. It had a 10-barrel daily production from the Gordon sand, and at the end of two months it was making 2 to 3 barrels daily.

Southeastward 1.5 miles there occur two light oil wells in the Gordon. The following is a record of one of these wells as published in Vol. I (edition exhausted) of the State Survey, page 248. The record is very complete, but some changes in the original log are indicated in parentheses by the writer:

Seth Pigott No. 1 Well (378).

Located in Sardis District, 2 miles N. 70° E. of Wallace. Authority, South Penn Oil Company.

(Elevation, 1125' B-A. T.)	Thickness Feet.	Total. Feet.
Conductor	14	14
Limestone, hard	3	17
Slate	43	60
Coal, (Washington)	2	62
Sand, (Mannington)	38	100
Limestone	100	200
Red rock	50	250
Unrecorded	235	485
Limestone and slate	105	590
Coal, Pittsburgh	8	598
Limestone and slate	102	700
Red rock	100	800
Slate	60	860
Red rock (Pittsburgh)	15	875
Sand	30	905
Limestone	55	960
Sand, white (I Cow Run)	95	1055
Limestone	13	1068
Slate	12	1080

	Thickness. Feet.	Total. Feet.
Limestone	10	1090
Sand	55	1145
Sand, white	55	1200
Limestone	44	1244
Slate and limestone	26	1270
Slate, black	30	1300
Sand	270	1570
Limestone	35	1605
Sand, white	95	1700
Slate, black	48	1748
Sand, (Maxton)	20	1768
Limestone and slate	87	1855
Pencil cave	6	1861
Big Limestone	51	1912
Sand, soft, and limestone (gas, 1937') 60' Sand, hard 20 Big Injun	80	1992
Limestone	168	2160
Slate	40	2200
Slate and limestone	100	2300
Sand and limestone (Berea)	50	2350
Limestone	50	2400
Slate	90	2490
Gantz sand (gas, 2495')	20	2510
Slate	15	2525
Fifty-foot sand	10	2535
Slate	55	2590
Limestone	10	2600
Red rock	25	2625
Sand, (Thirty-foot)	25	2650
Limestone	10	2660
Sand 10' Limestone 10 Sand and limestone 48 (Stray)	68	2728
Slate	3	2731
Sand, pebbly (oil, 2731') 5' Sand, hard 14 Slate 10 Campbells Run (Gordon)	29	2760
Sand, Whetstone Run (Gordon) (gas, 2765')	20	2780
Limestone and slate	20	2800
Sand, Flat Run (Fourth)	2	2802
Slate and limestone	199 9"	3001 9"

One-half mile southward, the Hartman Oil Company drilled the J. L. Swiger No. 1 dry hole (379) through the entire Venango group of oil sands, the record of which is given in detail on page 311 of Vol. I(A) of the State Survey reports. The well starts 2 feet below the Washington coal and penetrates 3112 feet below the top of the Pittsburgh bed.

Three-fourths mile northwestward on Little Elk the

South Penn drilled the Blackburn Smith No. 1 gas well (376), the log of which was not obtained.

The three following records are from wells situated on the north side of Little Tenmile creek. The first is located on the head of Caldwell run:

John G. Rogers No. 1225 Well Record (381).

Located in Sardis District, 1.6 miles northeast of Brown. Authority, C. A. Murrin. Completed Sept. 25, 1910.

(Elevation, 1300′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	30	30
Coal, (Washington), and unrecorded	68	98
Native coal (Waynesburg "A")	2	100
Unrecorded	470	570
Coal, Pittsburgh?	6	576
Unrecorded (no Dunkard sands)	704	1280
Gas sand	57	1337
Unrecorded	88	1425
Salt sand	75	1500
Unrecorded	6	1506
Unrecorded	258	1764
Maxton sand	85	1849
Unrecorded	3	1852
Little lime	8	1860
Pencil cave	5	1865
Big Lime	35	1900
Big Injun sand (gas, 1925′)	80	1980
Unrecorded to bottom	8	1988

10″ casing, 606′; 8¼″ casing, 1245′; 6⅝″ casing, 1900′.

Temple Smith No. 2107 Well Record (374).

Located in Sardis District, ½ mile northwest of Brown. Authority, Philadelphia Company. Completed July 9, 1906.

(Elevation, 1115′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	590	590
Coal, Pittsburgh	6	596
Unrecorded	504	1100
Big Dunkard sand	50	1150
Unrecorded	720	1870
Big Lime	40	1910
Big Injun sand (oil, gas and water, 1940′-2000′)	125	2035
Unrecorded	455	2490
Fifty-foot sand (gas, 2492′)	44	2534
Slate to bottom	1	2535

Pressure in 4″ tubing:

1st minute, 135 lbs.	10th minute, 310 lbs.
5th minute, 280 lbs.	20th minute, 333 lbs.

This well starts 5 to 10 feet below the Washington coal. It is reported to have had a 25-barrel oil showing in the Big Injun, but the oil was never saved.

G. W. Kelley No. 1 Well Record (375).

Located in Sardis District, ¾ mile northwest of Brown. Authority, Carnegie Natural Gas Company.

(Elevation, 1070′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	570	570
Coal, Pittsburgh	7	577
Unrecorded	1308	1885
Big Injun sand	113	1998
Unrecorded	459	2457
Fifty-foot sand (gas, 2460′-2465′)	45	2502
Unrecorded	39	2541
Thirty-foot sand (gas, 2547′)	19	2560
Unrecorded	40	2600
Gordon Stray sand and unrecorded	81	2681
Gordon sand	22	2703
Unrecorded	3	2706
Fourth sand	14	2720
Unrecorded	120	2840
Fifth sand	7	2847
Unrecorded to bottom	35	2882

10″ casing, 218′; 8¼″ casing, 1062′; 6⅝″ casing, 1978′.
"Good for 1,000,000 cu. ft. daily."

The log of the I. L. Marsh No. 1 well (373) is published in connection with the Brown section, page 90. This well is mentioned in the description of the Big Dunkard sand, page 274.

On the south hillside at Brown, the Philadelphia Company drilled a well which produces oil in the Gordon. Gas was encountered in both the Big Dunkard and Fifty-foot. Its record is as follows:

E. E. S. Rogers No. 2140 Well Record (372).

Located in Sardis District at Brown. Authority, Philadelphia Company.

(Elevation, 1060′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	476	476
Coal, Pittsburgh	10	486
Unrecorded	514	1000
Big Dunkard sand (gas, 1010′)	80	1080
Unrecorded	70	1150

	Thickness. Feet.	Total. Feet.
Sand, Salt? ("Gas" and II Cow Run)	208	1358
Unrecorded	382	1740
Big Lime	56	1796
Big Injun sand	100	1896
Unrecorded	481	2377
Sand, Thirty-foot? (Fifty-foot) (gas, 2388')	35	2412
Unrecorded	118	2530
Gordon Stray sand	25	2555
Unrecorded	17	2572
Gordon sand (oil, 2584½')	49	2621
Unrecorded	4	2625
Fourth sand (oil)	6	2631

10" casing, 183'; 8¼" casing, 1000'; 6⅝" casing, 1914'.

The two following records are from gassers located on the waters of Little Rockcamp, southwest of Brown:

S. T. Flanagan No. 1 Well Record (370).

Located in Sardis District, 1.5 miles southwest of Brown. Authority, Philadelphia Company.

(Elevation, 1175' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	200	200
Coal, native, (Washington)	3	203
Unrecorded	302	505
Coal, (Lower Uniontown)	4	509
Unrecorded	151	660
Lime shells	80	740
Unrecorded	8	748
Coal, Mapletown? (Redstone)	4	752
Unrecorded	23	775
Coal, Pittsburgh	7	782
Unrecorded	363	1145
Sand, Little Dunkard (I Cow Run)	95	1240
Unrecorded	75	1315
Big Dunkard sand	30	1345
Unrecorded	155	1500
Gas sand	25	1525
Unrecorded	117	1642
Coal, Pocahontas? (Upper Mercer?)	6	1648
Unrecorded	7	1655
Salt sand (water, 3 bailers per hour, 1685')	75	1730
Unrecorded	52	1782
Salt sand	14	1796
Unrecorded	54	1850
Maxton sand	80	1930
Unrecorded	66	1996
Little lime	15	2011
Pencil cave, blue	5	2016
Big Lime	61	2077
Big Injun sand, hard	123	2200
Unrecorded	6	2206

	Thickness. Feet.	Total. Feet.
Squaw sand	10	2216
Unrecorded	409	2625
Fifty-foot sand (gas, 2750', steel line)	55	2680
Unrecorded	60	2740
Thirty-foot sand (gas, 2750', steel line)	30	2770
Unrecorded	15	2785
Gordon Stray sand (gas)	60	2845
Unrecorded	11	2856
Gordon sand (oil, 2884')		

The above is a very interesting record in that five coal beds, three gas pays, and one oil pay are noted:

T. P. Whiteman No. 1 Well Record (369).

Located in Sardis District, 1.7 miles northwest of Olive. Authority, South Penn Oil Company.

(Elevation, 1040' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1880	1880
Big Injun sand	150	2030
Unrecorded	647	2677
Gordon sand	33	2710
Unrecorded	230	2940
Fifth sand and unrecorded to bottom	23	2963

The following is the record of a well southeast of Brown that reveals the absence of both the Fourth and Fifth sands:

W. N. Edgell No. 2147 Well Record (382).

Located in Sardis District, 1 mile southeast of Brown. Authority, Philadelphia Company.

(Elevation, 1005' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	290	290
Coal, Pittsburgh	15	305
Unrecorded	1305	1610
Big Lime	34	1644
Big Injun sand	100	1744
Unrecorded	636	2370
Gordon sand	120	2490
Unrecorded to bottom (no Fourth or Fifth sand)	306	2796

10" casing, 150'; 8¼" casing, 867'; 6⅝" casing, 1730'.
Well starts 10 feet below the Uniontown coal.

The two following records are from Big Injun and Fifth sand gassers:

H. H. Huston No. 1 Well Record (383).

Located in Sardis District, 1¼ miles southeast of Brown. Authority, Carnegie Natural Gas Company.

(Elevation, 965′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	106	106
Coal, Pittsburgh, and unrecorded	1384	1490
Big Injun sand (gas, 1520′)	94	1584
Unrecorded	476	2060
Fifty-foot sand	20	2080
Unrecorded	69	2149
Sand, Gordon? (Stray) (gas, 2151′)	9	2158
Unrecorded	79	2237
Fourth sand	53	2290
Unrecorded	10	2300
Fifth sand (gas, 2309′) to bottom	16	2316

10″ casing, 140′; 6⅝″ casing, 1462′; 3″ tubing, 2316′.
Pressure in 3″ pipe, first minute, 235 lbs.

Nancy Haggerty No. 1 Well Record (384).

Located in Sardis District, 1 mile southwest of Dola. Authority, Hope Natural Gas Company.

(Elevation, 1140′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1420	1420
Big Injun sand (gas)	70	1490
Unrecorded	730	2220
Gordon sand	20	2240
Unrecorded	169	2409
Fifth sand (gas)	8	2417
Unrecorded to bottom	48	2465

The following is the record of a well in the southeast portion of Sardis on Flaggy run:

Wm. T. Allen No. 1 Well Record (387).

Located in Sardis District, 1 mile west of Sardis. Authority, Carnegie Natural Gas Company.

(Elevation, 985′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1440	1440
Big Injun sand	100	1540
Unrecorded	314	1854
Sand, Fifty-foot? (Berea)	46	1900
Unrecorded	85	1985
Sand, Thirty-foot? (Fifty-foot)	30	2015
Unrecorded	35	2050
Sand, Gordon Stray (30-ft. and Stray) (gas, 2064′)	90	2140
Unrecorded	25	2165

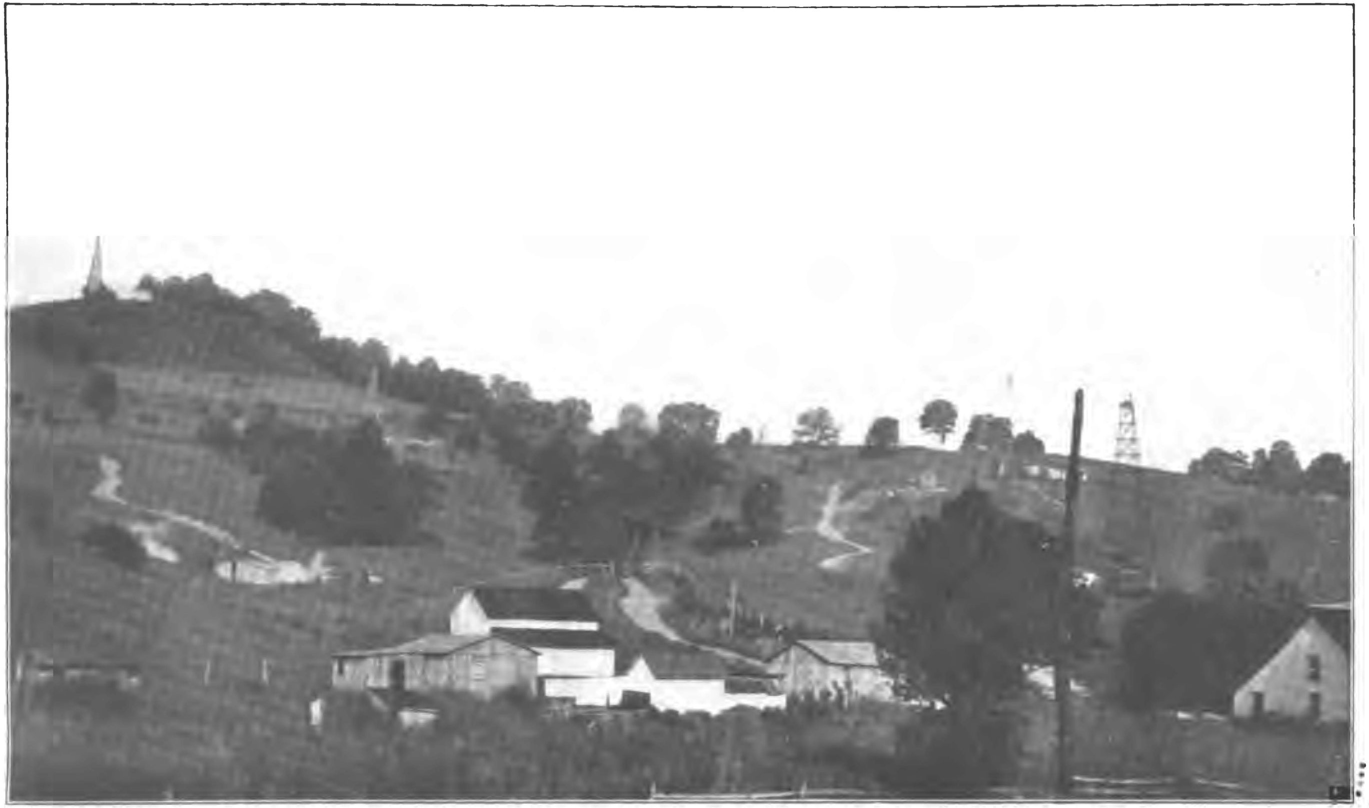


PLATE XIII.—Shinnston Oil Field on Coons run. Topography of Monongahela series in background, and Conemaugh series in immediate foreground.

	Thickness. Feet.	Total. Feet.
Gordon sand	25	2190
Unrecorded	45	2235
Fourth sand	20	2255
Unrecorded	115	2370
Fifth sand (some gas)	29	2399
Unrecorded to bottom	106	2505

Pressure at 15 minutes, 200 lbs.; rock pressure, 575 lbs.

The well starts 5 feet above the base of the Pittsburgh coal bed.

A short distance westward there occurs a fine pool of Maxton sand gas. The A. A. Swiger No. 1 (385) and Nancy Griffin No. 6 (388) both produce gas at this horizon. The L. S. Whiteman No. 1 (386), located on the head of Isaac creek, is reported a 5-barrel oil well in the Gordon sand.

The following is the record of a gas well located only ¾ mile west of the crest of the Wolf Summit anticline:

Oliver Robinson No. 2159 Well Record (392).

Located in Sardis District, at Sardis. Authority, Philadelphia Company.

(Elevation, 955′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	155	155
Coal, (Harlem?)	3	158
Unrecorded	107	265
Sand, Big Dunkard? (I Cow Run)	20	285
Unrecorded	10	295
Big Dunkard sand	98	393
Unrecorded	177	570
Gas sand and unrecorded	180	750
Salt sand	125	875
Unrecorded	340	1215
Big Lime	55	1270
Big Injun sand	110	1380
Unrecorded	430	1810
Fifty-foot sand	69	1879
Unrecorded	16	1895
Sand, Gordon? (Thirty-foot) (gas, 1910′)	20	1915
Unrecorded	105	2020
Sand, Fourth? (Gordon)	30	2050
Unrecorded	182	2232
Fifth sand (gas, 2236′)	16	2248
Unrecorded to bottom	18	2266

10″ casing, 395′; 8¼″ casing, 880′; 6⅝″ casing, 1259′; 3″ casing, 2246′.

"Pressure test in 6⅝" pipe:
1st minute, 20 lbs.
5th minute, 90 lbs.
10th minute, 150 lbs.
20th minute, 215 lbs.

"Pressure test in 3" pipe:
1st minute, 130 lbs.
2nd minute, 160 lbs.
5th minute, 230 lbs.
10th minute, 290 lbs.

The well starts 140 feet below the Pittsburgh coal; hence, the bed at 155′ feet represents the Harlem.

The following is the record of a light Fifth sand gasser on the head of Katys Lick creek in the extreme southern edge of Sardis district. The well starts 30 to 40 feet above the Pittsburgh coal:

James Flanagan No. 2145 Well Record (393).

Located in Sardis District, ¼ mile southeast of Katys Lick. Authority, Philadelphia Company. Completed April 17, 1907.

(Elevation, 1150′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	315	315
Coal, (Harlem?)	6	321
Unrecorded	169	490
Big Dunkard sand	105	595
Unrecorded	195	790
Sand, Salt? ("Gas")	90	880
Unrecorded	25	905
Sand, Salt? (II Cow Run and Salt)	113	1018
Unrecorded	110	1128
Sand, Maxton? (Salt)	32	1160
Unrecorded	222	1382
Big Lime	61	1443
Big Injun sand	95	1538
Unrecorded	432	1970
Fifty-foot sand	10	1980
Unrecorded	6	1986
Sand, Gordon Stray? (Thirty-foot)	59	2045
Unrecorded	15	2060
Sand, Gordon? (Gordon Stray)	20	2080
Unrecorded	56	2136
Sand, Fourth? (Gordon)	20	2156
Unrecorded	64	2220
Sand, Fifth? (Fourth)	6	2226
Unrecorded	174	2400
Fifth sand (gas, 2402′)	5	2405
Unrecorded to bottom	197	2602

10″ casing, 144′; 8¼″ casing, 1020′; 6⅝″ casing, 1394′.
Well abandoned and plugged at 1450′.

Prospective Oil and Gas Territory, Sardis District.—The northwest portion of Sardis district has been quite thoroughly drilled, but there still remains a large acreage that is favorable for oil and gas both from the standpoint of development and structure. (1) That portion of the district in the Robinson Basin northwest from the head of Barnes run to Little Tenmile creek, appears good for Gordon sand oil; (2) that, northward from Fonda to Barnes run, between the axis of the Robinson syncline and the 275-foot contour of the Pittsburgh coal, seems favorable for oil at the same horizon; (3) that, westward from the Benjamin Heldreth No. 1 well (330) on the head of Little Elk creek appears good for Gordon oil; (4) that, southward from Brown to Little Rockcamp run, for gas in the Fifty-foot, Gordon and Fifth; (5) that, northeast and eastward from Brown to Bennett run, appears favorable for gas at the same horizons; and (6) that, on the left branch of Flaggy run, for gas in the Maxton, Big Injun and Fifth sands.

TEN MILE DISTRICT.

Ten Mile district occupies the middle western portion of Harrison county. Its entire area lies in the Robinson Basin. A glance at the structure map accompanying this report will show that the Pittsburgh coal bed varies in elevation from 200′ A. T. near the axis of the Robinson syncline on the northwest corner of the district to 1100′ A. T., 0.8 mile southeast of Wolf Summit, 1.5 miles westward from the axis of the Wolf Summit anticline. Hence, ideal structural conditions prevail therein for the great oil and gas fields within its boundaries. This district has produced more oil than any other in Harrison county. The main oil horizons are the Maxton, Fifty-foot, Gordon, and Fifth sands.

The Gordon production lies chiefly in the Robinson Basin along the western border of the district, and along with the Fifth sand is the most important oil horizon from the standpoint of total production. The location of the pool is ideal as regards the "anticlinal theory" for the accumulation of oil and gas into commercial pools.

The fifth sand oil pool occupies a high structural level to the southeast slightly over half way up the western slope of the Wolf Summit anticline. The Fifth sand contains no water in this region, so that it would appear that the location of this oil pool is in direct violation of the anticlinal theory of oil segregation, since the oil should apparently pass down into the Robinson Basin. The records of several deep wells to the northwest of the pool, however, reveal the absence of the Fifth sand, tending to show the sand deposit more or less lenticular. The latter feature no doubt in a large measure accounts for the oil so high up the structural slope.

A small Fifty-foot sand oil pool was opened on Indian run, 2 miles north of Bristol, during 1901, directly over a Gordon sand oil pool. The oil was dark and heavy, the production falling off rapidly, and the wells later drilled on down to the Gordon.

A small Maxton oil pool occurs on the east side of Raccoon run, 1.2 miles southward from Bristol, as represented by the S. S. Cross No. 1 well (461).

The development in detail will now be considered from northwest to southeast across the district. In addition to the summarized records (page 408) of the following wells in the Gordon sand oil pool, arranged from northeast to southwest along the Robinson Basin, their more complete logs are published on the pages indicated of Vol. I(A) of the State Survey reports:

Map No.	Name of Well.	Location.	Page of Vol. I(A).
402	T. D. Rogers No. 1....	2.5 miles W. of Olive.........	310
403	J. Lough No. 1........	2.5 miles N. W. of Marshville..	315
406	Luther Haymond No. 1.	3.3 miles N. of Salem.........	314
408	J. W. Williams No. 1..	1.8 miles N. of Bristol........	314
409	J. W. Williams No. 2..	2 miles N. of Bristol........	314
413	A. C. Bailey No. 1.....	2.5 miles N. of Salem.........	323
421	Martha Traugh No. 1..	In Salem, east edge of........	316
433	Silas Fittro No. 2......	2 miles S. W. of Salem.......	292

All the above wells produced oil from the Gordon sand. Rogers No. 1 (402) had an initial production of 275 barrels daily; Lough No. 1 (403), 40 barrels daily, along with gas in the Fifty-foot sand; Haymond No. 1 (406) in addition to a Gordon oil production had an oil show at a depth of 3257 feet in the Gordon Stray sand and not in the Thirty-foot as given in the record; Williams Nos. 1 and 2 (408 and 409) were also gassers in the Fifty-foot; Bailey No. 1 (413), was a gasser in the Gordon Stray; Traugh No. 1 (421) had an initial production of 4 to 6 barrels daily.

The fifteen following records from Gordon sand oil wells scattered along the Robinson Basin in Ten Mile district, contain much data of interest concerning other oil and gas horizons than the Gordon:

John T. Goodwin No. 1 Well Record (397).

Located in Ten Mile District, 3¾ miles north of Bristol. Authority, South Penn Oil Company.

(Elevation, 1075' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	860	860
Coal, Pittsburgh	6	866
Unrecorded	514	1380
Big Dunkard sand	70	1450
Unrecorded	400	1850
Salt sand	60	1910
Unrecorded	185	2095
Big Lime	75	2170
Big Injun sand	130	2300
Unrecorded	403	2703
Fifty-foot sand and unrecorded	157	2860
Gordon Stray sand	46	2906
Unrecorded	21	2927
Gordon sand (oil)	25	2952
Unrecorded to bottom	17	2969

Luther Haymond No. 15 Well Record (405).

Located in Ten Mile District, 3.5 miles N. 10° E. of Salem. Authority, South Penn Oil Company.

(Elevation, 1140' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	905	905
Pittsburgh coal	6	911
Unrecorded	529	1440
Sand, Dunkard (Big Dunkard)	60	1500
Unrecorded	250	1750
Sand, Salt? (II Cow Run)	60	1810
Unrecorded	345	2155
Big Lime	60	2215
Big Injun sand	95	2310
Unrecorded	457	2767
Fifty-foot sand	38	2805
Unrecorded	35	2840

	Thickness. Feet.	Total. Feet.
Thirty-foot sand	20	2860
Unrecorded	70	2930
Stray sand	22	2952
Unrecorded	15	2967
Gordon sand (oil)	21	2988
Unrecorded to bottom	24	3012

The G. W. Williams No. 1 well, located on Grass run, 2.5 miles northwest of Marshville, is reported to have had an initial production of 1200 barrels daily in the Gordon sand when drilled in 1902. Still making (August, 1910) 8 to 10 barrels daily.

Susan Barnes No. 5 Well Record (410).

Located in Ten Mile District, 2¼ miles north of Bristol. Authority, South Penn Oil Company.

(Elevation, 1085' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	770	770
Coal, Pittsburgh	7	777
Unrecorded	513	1290
Sand, Dunkard (Big Dunkard)	20	1310
Unrecorded	270	1580
Sand, Salt? (II Cow Run and Salt)	110	1690
Unrecorded	340	2030
Big Lime	65	2095
Big Injun sand	5	2100
Unrecorded	520	2620
Fifty-foot sand	33	2653
Unrecorded	70	2723
Thirty-foot sand	20	2743
Unrecorded	56	2799
Stray sand	15	2814
Unrecorded	25	2839
Gordon sand (oil)	22	2861
Unrecorded to bottom	62	2923

A. J. Varner No. 8 Well Record (414).

Located in Ten Mile District on the head of Jacobs run, 2¼ miles north of Salem. Authority, South Penn Oil Company.

	Thickness. Feet.	Total. Feet.
Unrecorded	945	945
Coal, Pittsburgh	5	950
Unrecorded	420	1370
Sand, Dunkard? (I Cow Run)	35	1405
Unrecorded	585	2090

	Thickness. Feet.	Total. Feet.
Maxton sand	65	2155
Unrecorded	40	2195
Big Lime	45	2240
Big Injun sand	115	2355
Unrecorded	433	2788
Fifty-foot sand	17	2805
Unrecorded	79	2884
Thirty-foot sand	25	2909
Unrecorded	56	2965
Stray sand	25	2990
Unrecorded	20	3010
Gordon sand (oil)	12	3022
Unrecorded to bottom	1	3023

The Fifty-foot sand throughout this portion of Harrison county comes 430 to 470 feet below the Big Injun sand.

A. C. Bailey No. 8 Well Record (415).

Located in Ten Mile District, 2 miles north of Salem on Cherrycamp run. Authority, South Penn Oil Company.

(Elevation, 1145' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	945	945
Pittsburgh coal and unrecorded	500	1445
Dunkard sand (Big Dunkard)	25	1470
Unrecorded	530	2000
Salt sand	80	2080
Unrecorded	115	2195
Big Lime	45	2240
Big Injun sand	105	2345
Unrecorded	455	2800
Fifty-foot sand	25	2825
Unrecorded	75	2900
Thirty-foot sand	30	2930
Unrecorded	44	2974
Stray sand	19	2993
Unrecorded	25	3018
Gordon sand (oil) to bottom	26	3044

Thomas Williams No. 1 Well Record (416).

Located in Ten Mile District, on Cherrycamp run, 2 miles north of Salem. Authority, South Penn Oil Company.

	Thickness. Feet.	Total. Feet.
Unrecorded	967	967
Pittsburgh coal	5	972
Unrecorded	578	1550
Sand, Dunkard (Burning Springs)	60	1610
Unrecorded	190	1800

	Thickness. Feet.	Total. Feet.
Sand, Salt? (II Cow Run)	80	1880
Unrecorded	60	1940
Sand, Maxton? (Salt)	30	1970
Unrecorded	250	2220
Big Lime	40	2260
Big Injun sand	65	2325
Unrecorded	515	2840
Fifty-foot sand	10	2850
Unrecorded	50	2900
Thirty-foot sand	39	2939
Unrecorded	53	2992
Stray sand	18	3010
Unrecorded	23	3033
Gordon sand (oil)	15	3048
Unrecorded to bottom	21	3069

James Morris No. 3 Well Record (417).

Located in Ten Mile District, 1 mile northwest of Bristol. Authority, South Penn Oil Company.

(Elevation, 1170′ L-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	860	860
Coal, Pittsburgh	5	865
Unrecorded	520	1385
Sand, Dunkard (Big Dunkard)	50	1435
Unrecorded	180	1615
Gas sand	35	1650
Unrecorded	50	1700
Sand, Maxton? (Salt)	90	1790
Unrecorded	350	2140
Big Lime	60	2200
Big Injun sand	105	2305
Unrecorded	500	2805
Thirty-foot sand	25	2830
Unrecorded	40	2870
Stray sand	30	2900
Unrecorded	16	2916
Gordon sand (oil)	30	2946
Unrecorded to bottom	464	3410

Joseph Rosier Heirs No. 1 Well Record (418).

Located in Ten Mile District, 1 mile northwest of Bristol. Authority, Moon Oil & Gas Company. Completed Sept. 27, 1907.

(Elevation, 1055′ L-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	730	730
Coal, Pittsburgh	6	736
Unrecorded	523	1259
Big Dunkard sand	65	1324
Unrecorded	361	1685

	Thickness. Feet.	Total. Feet.
Gas? sand (Salt)	95	1780
Unrecorded (Salt sand only shells and broken)	108	1888
Maxton sand	63	1951
Unrecorded (Little Lime, broken; no pencil cave)	62	2013
Big Lime	63	2076
Big Injun sand	75	2151
Unrecorded	308	2459
Berea Grit	43	2502
Unrecorded	86	2588
Fifty-foot sand	7	2595
Unrecorded	81	2676
Thirty-foot sand (gas, 2688')	23	2699
Unrecorded	45	2744
Gordon Stray	42	2786
Unrecorded	19	2805
Gordon sand (oil, 2809'-2817')	19	2824
Unrecorded to bottom	17	2841

10" casing, 194'; 8¼" casing, 1280'; 6⅝" casing, 2236'.
Shot with 60 quarts.

Elizabeth Moon No. 1 Well Record (420).

Located in Ten Mile District, ¾ mile northwest of Bristol. Authority, G. M. Allender.

(Elevation, 1175' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	460	460
Sand, Bluff? (Carroll)	82	542
Unrecorded	304	846
Coal, Pittsburgh	7	853
Unrecorded	441	1294
Sand, Little Dunkard (I Cow Run)	30	1324
Unrecorded	51	1375
Big Dunkard sand	55	1430
Unrecorded	371	1801
Salt sand	95	1896
Unrecorded	108	2004
Maxton sand	63	2067
Unrecorded	62	2129
Big Lime	63	2192
Big Injun sand	88	2280
Unrecorded	295	2575
Berea Grit	43	2618
Unrecorded (No Fifty-foot sand)	74	2792
Thirty-foot sand	23	2815
Unrecorded	40	2855
Gordon Stray sand (gas, 2893')	42	2897
Unrecorded	21	2916
Gordon sand (oil, 2928')	21	2937
Unrecorded to bottom	29	2966

10" casing, 220'; 8¼" casing, 1375'; 6⅝" casing, 2298'.

M. V. Davisson No. 1 Well Record (422).

Located in Ten Mile District, 1 mile north of Salem. Authority, G. M. Allender.

(Elevation, 1090' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	860	860
Pittsburgh coal	6	866
Unrecorded	519	1385
Big Dunkard sand	70	1455
Unrecorded	280	1735
Salt sand (no water)	105	1840
Unrecorded	275	2115
Pencil cave	5	2120
Big Lime	55	2175
Big Injun sand (light gas, 2246')	110	2285
Unrecorded	425	2710
Fifty-foot sand (shells only) and unrecorded	82	2792
Thirty-foot sand	25	2817
Unrecorded	51	2868
Gordon Stray sand	44	2912
Unrecorded	1	2913
Gordon sand (oil, 2919'-2926')	19	2932
Unrecorded to bottom	28	2960

10" casing, 239'; 8¼" casing, 1390'; 6⅝" casing, 2321'.

G. E. Harbert No. 1 Well Record (424).

Located in Ten Mile District, 2 miles northwest of Salem. Authority, Carter Oil Company. Completed January 3, 1901.

(Elevation, 1160' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	960	960
Pittsburg coal, good	10	970
Unrecorded	95	1065
Cave	345	1410
Sand, Cow Run (I Cow Run)	20	1430
Cave	60	1490
Unrecorded	335	1825
Salt sand (water, 1835')	110	1935
Unrecorded	215	2150
Maxton sand	16	2166
Unrecorded	75	2241
Big Lime	57	2298
Big Injun sand (gas and oil in top)	107	2405
Unrecorded	557	2962
Gordon Stray	10	2972
Unrecorded	20	2992
Gordon sand (oil, 2994'-2998' and 3004'-3010')	20	3012
Unrecorded	28	3040
Sand (Fourth), (oil, 3044'-3050') to bottom	21	3061

This well records oil in both the Gordon and Fourth sands, and also a show in the top of the Big Injun.

M. Davisson No. 11 Well Record (425).

Located in Ten Mile District, 1.5 miles northwest of Industrial Authority, South Penn Oil Company.

(Elevation, 1163' L-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	945	945
Coal, Pittsburgh	5	950
Unrecorded	510	1460
Sand, Dunkard (Big Dunkard)	40	1500
Unrecorded	340	1840
Salt sand	55	1895
Unrecorded	230	2125
Maxton sand	20	2145
Unrecorded	130	2275
Big Injun sand	110	2385
Unrecorded	530	2915
Sand, Fifty-foot? (Thirty-foot)	20	2935
Unrecorded	61	2996
Stray sand	21	3017
Unrecorded	25	3042
Gordon sand (oil) to bottom	10	3052

John F. Randolph No. 1 Well Record (426).

Located in Ten Mile District, 1 mile northwest of Industrial. Authority, South Penn Oil Company.

(Elevation, 1130' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	918	918
Coal, Pittsburgh	6	924
Unrecorded	516	1440
Sand, Dunkard (Big Dunkard)	30	1470
Unrecorded	335	1805
Salt sand	151	1956
Unrecorded	120	2076
Maxton sand	24	2100
Unrecorded	75	2175
Big Lime	60	2235
Big Injun sand	67	2302
Unrecorded	518	2820
Fifty-foot sand	15	2835
Unrecorded	112	2947
Stray sand	7	2954
Unrecorded	30	2984
Gordon sand (oil) to bottom	8	2992

Silas Fittro No. 1 Well Record (432).

Located in Ten Mile District, 2 miles southwest of Salem. Authority, South Penn Oil Company.

(Elevation, 1112' L-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1010	1010
Coal, Pittsburgh	5	1015
Unrecorded	510	1525

	Thickness. Feet.	Total. Feet.
Sand, Dunkard (Big Dunkard)	75	1600
Unrecorded	292	1892
Salt sand	48	1940
Unrecorded	362	2302
Big Lime	53	2355
Unrecorded	1	2356
Big Injun sand	144	2500
Unrecorded	550	3050
Stray sand	15	3065
Unrecorded	26	3091
Gordon sand (oil)	15	3106
Unrecorded to bottom	15	3121

The following is the detailed record of a well on the head of Patterson fork at the southwest border of Ten Mile district. The record includes in its top portion over 300 feet of the Dunkard series, and the Washington-Pittsburgh coal interval is shown to be 572 feet. Oil was encountered in both the Gordon Stray and Gordon sands:

Patterson No. 3 Well Record (434).

Located in Ten Mile District, 1½ miles south of Salem. Authority, R. T. Lowndes.

(Elevation, 1115′ B-A. T.)	Thickness. Feet.	Total. Feet.
Conductor	16	16
Red rock	30	46
Lime (water)	22	68
Black slate	15	83
Red rock, (Creston)	28	111
Lime	30	141
Slate	24	170
Red rock	20	190
Black slate	8	198
Coal, (Washington)	2	200
Slate	23	223
Sand (water) (Mannington)	40	263
Slate	31	294
Sand (water), (Waynesburg)	10	304
Red rock	29	333
Lime	20	353
Black slate	10	363
Lime	50	413
Sand, (Carroll) (Uniontown)	47	460
White slate	8	468
Black slate, (Uniontown coal horizon)	9	477
Lime	27	504
Red rock	10	514
Lime	30	544

	Thickness. Feet.	Total. Feet.
Black slate	24	568
Lime, (Benwood)	32	600
White sand 27' Lime 18 White sand 20 (Upper Sewickley)	65	665
Slate	20	685
Lime	6	691
Slate	9	700
Lime	27	727
Slate	22	749
Coal, (Redstone)	1	750
Lime, (Redstone)	17	767
Fire clay	5	772
Coal, Pittsburgh	6	778
Slate	10	788
Lime	18	806
Slate	22	828
Lime	13	841
Slate	30	871
Red rock	21	892
Black slate	12	904
Lime	18	922
Red rock	26	948
Sand, (Murphy)	40	988
Slate	27	1015
Lime	20	1035
Black slate	21	1056
Lime	27	1083
Slate	23	1106
Lime	9	1115
Slate	15	1130
Lime	24	1154
Black slate	20	1174
Lime shells	30	1206
Black slate	27	1233
Sand, (I Cow Run)	22	1255
Slate	40	1302
Sand, white, (Big Dunkard)	45	1347
Slate	30	1377
Lime	8	1385
Slate	30	1415
Lime	22	1437
Slate	18	1455
Lime	10	1465
Slate	33	1498
Lime	15	1513
Black slate	21	1534
Sand, (II Cow Run)	57	1591
Black slate	13	1604
Lime	1	1605
Slate	42	1647
Sand, (Salt)	21	1668
Slate	7	1675
Sand, (Salt)	103	1778
Slate	12	1790

	Thickness. Feet.	Total. Feet.
Lime	14	1804
Sand (Salt)	72	1876
Black slate	35	1911
Lime	20	1931
Black slate	35	1966
Lime	10	1976
Sand, (Maxton)	18	1994
Slate	15	2009
Lime	32	2041
Slate	14	2055
Lime	12	2067
Slate	8	2075
Big Lime	62	2137
Big Injun sand	93	2230
Slate	45	2275
Sand, Squaw	144	2426
Black slate	15	2441
Lime shells	22	2463
Slate	30	2493
Lime	27	2520
Berea Grit	32	2552
Slate	14	2566
Lime shells	27	2593
Black slate	30	2623
Lime slate	24	2647
White slate	27	2674
Black slate	16	2690
Lime	28	2718
Fifty-foot sand (gas, 2725′)	24	2742
White slate	17	2759
Lime shells	13	2772
Black slate	40	2812
Gordon Stray sand (oil, 2832′)	23	2835
Unrecorded	16	2851
Gordon sand (steel line measurement; little oil on top; oil, 2859′) soft and pebbly in lower part, and unrecorded to bottom	37	2888

10″ casing, 146′; 8¼″ casing, 1262′; 6⅝″ casing, 2282′.

A narrow belt of Gordon sand oil wells occurs 1.5 miles northeastward from Bristol, extending northeastward via the mouth of Indian run to Rockcamp run, ¾ mile west of Olive. The two following records are from wells in this pool:

F. L. Haney No. 1 Well Record (446).

Located in Ten Mile District, 1¼ miles southwest of Marshville. Authority, Graves and Parrish. Completed Dec. 8, 1905.

(Elevation, 970′ L-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	406	406
Pittsburgh coal	8	414

	Thickness. Feet.	Total. Feet.
Unrecorded	361	775
Big Dunkard sand	175	950
Unrecorded	150	1100
Gas sand (water, 1180')	100	1200
Unrecorded	100	1300
Salt sand	120	1420
Maxton sand	80	1725
Unrecorded	12	1737
Pencil cave	8	1745
Big Lime	55	1800
Big Injun sand	80	1880
Unrecorded	376	2256
Sand, Upper Thirty-foot? (Gantz)	20	2276
Unrecorded	60	2336
Fifty-foot sand	32	2368
Unrecorded	12	2380
Thirty-foot sand	30	2410
Unrecorded	15	2425
Gordon Stray sand	35	2460
Unrecorded	16	2476
Gordon sand (oil pay, 2508'-2515') to bottom	43	2519

10" casing, 155'; 8¼" casing, 924'; 6⅝" casing, 1900'; 5 3/16" casing, 2459'.

"Shot with 30 quarts, Dec. 9, 1905; shot with 20 quarts. June 27, 1906; shot with 10 quarts, May 14, 1907."

Jesse A. Harbert No. 1 Well Record (447).

Located in Ten Mile District, 1¾ miles northeast of Bristol. Authority, G. M. Allender, Contractor.

(Elevation, 1160' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	648	648
Pittsburgh coal	6	654
Unrecorded	401	1055
Sand, Little Dunkard, (I Cow Run)	30	1085
Unrecorded	66	1151
Big Dunkard sand	35	1186
Unrecorded	169	1355
Gas sand	45	1400
Unrecorded	445	1845
Maxton sand	133	1978
Little lime	4	1982
Pencil cave	4	1986
Big Lime	61	2047
Big Injun sand	70	2117
Unrecorded	296	2413
Berea sand	17	2430
Unrecorded	105	2535
Fifty-foot sand	23	2558
Unrecorded	76	2634
Thirty-foot sand	20	2654
Unrecorded	3	2657
Gordon Stray sand (little gas 2657')	43	2700

	Thickness. Feet.	Total. Feet.
Unrecorded	5	2705
Gordon sand (little oil, 2722')	35	2740
Unrecorded	8	2748
Fourth sand	38	2786
Unrecorded	183	2969
Fifth sand (little oil, 2974')	5	2974
Unrecorded to bottom	139	3113

10" casing, 283'; 8¼" casing, 1176'; 6⅝" casing, 1992'.

Slightly over a mile northwest from Marshville, the Kinch Oil & Gas Company drilled the T. S. Morris No. 1 (437) gasser in the Maxton sand. The well had a rock pressure of 560 pounds to the square inch, and is probably in the same Maxton gas pool as the wells (385 and 388) one mile southeast from Olive.

The Chas. Lanham No. 1 well (441), located 0.6 mile northeast from Marshville, is reported to have had an initial production of 840 barrels daily from the Gordon sand.

In addition to the summarized records as given in the table of wells for Harrison county, page 408, the more complete records of the following list of wells are published on the pages indicated of Vol. I(A) of the State Survey reports. The wells are mostly oil producers from the Gordon and Fifth sands:

Map No.	Name of Well.	Location.	Page of Vol. I(A).
443	D. Boughner No. 1	1.0 mile S. E. of Marshville.	325
444	B. H. Brown No. 13	0.5 mile S. E. of Marshville.	326
445	B. H. Brown No. 12	0.4 mile S. E. of Marshville.	326
463	J. M. Fultz No. 6	1.5 mile S. W. of Lynch	321
464	J. M. Fultz No. 4	1.5 mile S. 35° W. of Lynch.	321
465	G. W. Albright No. 1	1.5 mile S. 20° E. of Bristol.	320
467	G. W. Albright No. 3	1.6 mile S. of Bristol	320

The four following records are from wells in the same Wolf Summit-Jarvisville oil pool in the Fifth sand:

Wilson Williams No. 1 Well Record (448).

Located in Ten Mile District, 1¼ miles north of Wolf Summit. Authority, South Penn Oil Company.

(Elevation, 1400' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	990	990
Big Dunkard sand	132	1122

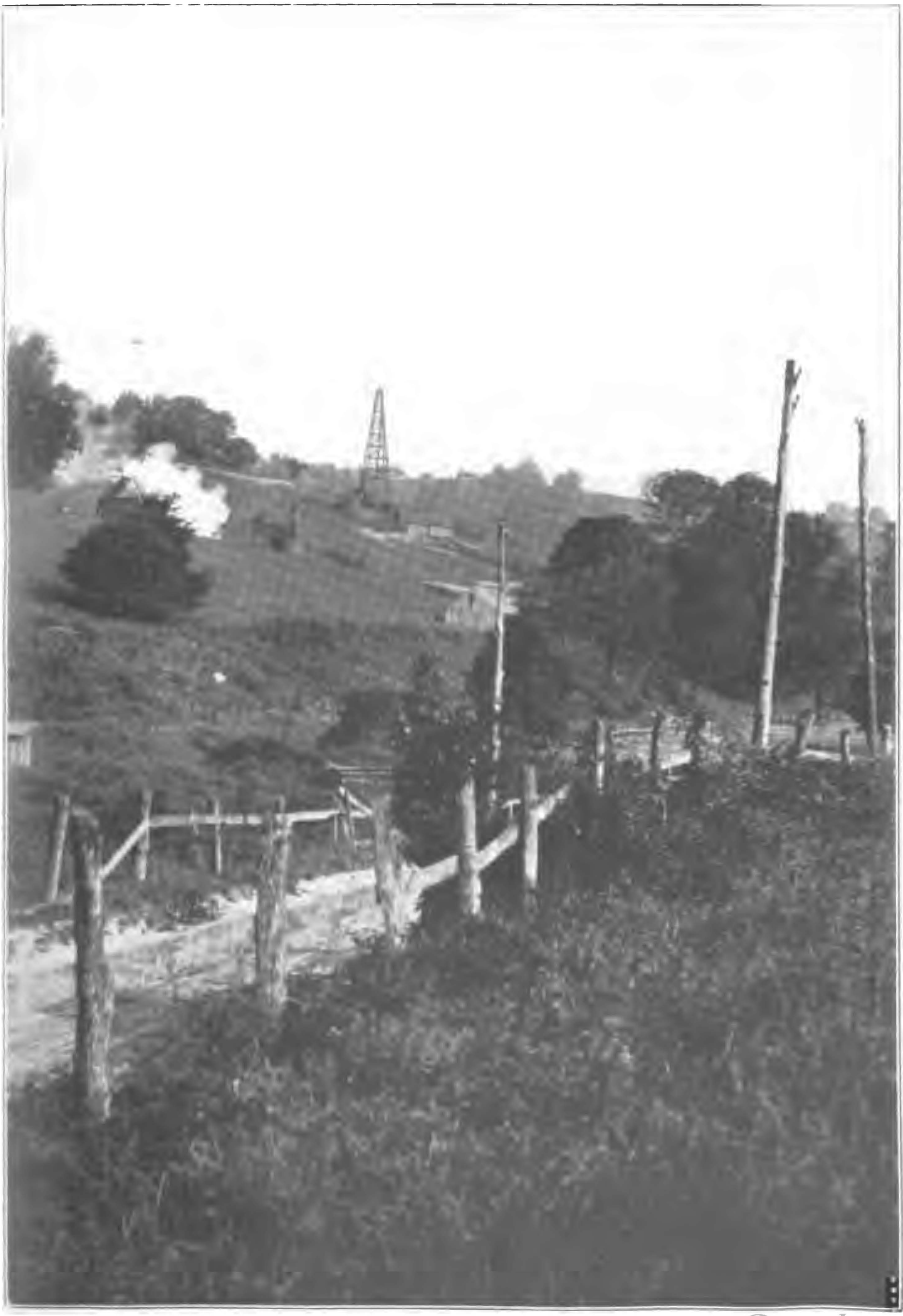


PLATE XIV.—Famous Swiger Oil Well (618), represented by derrick near middle of sky-line. The steel-tube derrick on the left is the great Whiteman No. 2 well (619).

	Thickness. Feet.	Total. Feet.
Unrecorded	788	1910
Big Lime	75	1985
Unrecorded	5	1990
Big Injun sand	70	2060
Unrecorded	460	2520
Fifty-foot sand	60	2580
Unrecorded	110	2690
Gordon sand	30	2720
Unrecorded	185	2905
Fifth sand (oil)	7	2912
Unrecorded to bottom	14	2926

The well starts 25 feet below the Washington coal, according to D. B. Reger; hence, the Pittsburgh coal horizon belongs at about 550 feet. The Fifth sand apparently belongs 215 feet below the top of the Gordon.

J. G. Dakon No. 3 Well Record (456).

Located in Ten Mile District, ¾ mile northwest of Lynch. Authority, R. T. Lowndes. Completed in December, 1902.

(Elevation, 1192′ L-A. T.)	Thickness. Feet.	Total. Feet.
Conductor	8	8
Brown slate	72	80
Sand (water)	10	90
White slate	25	115
Red rock	10	125
White slate	50	175
Red rock	25	200
Sand, (Gilboy)	50	250
White slate	40	290
Lime	50	340
Black slate	10	350
Lime	85	435
Blue slate	19	454
Green sand	6	460
Green slate	20	480
White slate	20	500
Lime	20	520
Red rock	10	530
Brown slate	27	557
Coal, (Redstone)	5	562
Lime, (Redstone)	10	572
Brown slate	10	582
Pittsburgh coal	8	590
White slate	30	620
Sand	10	630
Slate, white	10	640
Lime	36	676
White sand	4	680

	Thickness. Feet.	Total. Feet.
Sand, (Minshall) (Connellsville)	50	730
White slate	10	740
Red rock	15	755
Lime	10	765
Red rock	120	885
Lime	30	915
Red rock	25	940
Lime	20	960
Brown slate	10	970
Lime	16	986
White slate	26	1012
Sand, Little Dunkard (I Cow Run)	36	1048
Black slate	32	1080
Lime	30	1110
Big Dunkard sand	55	1165
Black slate	55	1170
Lime	30	1200
Sand, ("Gas")	14	1214
Black slate	46	1260
Lime	15	1275
Sand, Salt? ("Gas" and II Cow Run)	125	1400
Black slate	15	1415
Salt sand	32	1447
Black lime	21	1468
Black slate	72	1540
Sand, (Salt)	72	1612
Black slate	28	1640
Sand, (Salt)	48	1688
Slate	57	1745
Lime	80	1825
White slate	5	1830
Lime	10	1840
Blue Monday sand	66	1906
Big Lime	70	1976
Big Injun sand	74	2050
Red rock	10	2060
Lime	160	2220
Blue slate	15	2235
Black lime	10	2245
White slate	35	2280
Lime	20	2300
Black slate	50	2350
Gantz sand	10	2360
Lime	60	2420
Black slate	45	2465
Fifty-foot sand (little gas at top)	35	2500
Slate	45	2545
Thirty-foot sand	15	2560
White slate	8	2568
Broken sand	67	2635
Black slate	7	2642
Gordon Stray (oil show, 2666½')	44	2686
Slate	6	2692
Sand, Fourth? (Gordon) sand, gas in top	50	2742
Slate and shells	163	2905

	Thickness. Feet.	Total. Feet.
Fifth sand (oil and gas show)	3	2908
Unrecorded to bottom	30	2938

10″ casing, 120′; 8¼″ casing, 1080′; 6⅝″ casing, 2012′.

L. E. Stout* No. 1 Well Record (470).

Located in Ten Mile District, 1.1 miles northwest of Jarvisville Authority, South Penn Oil Company.

	Thickness. Feet.	Total. Feet.
Unrecorded	325	325
Pittsburgh coal and unrecorded (water, 1655′)	1430	1755
Big Injun sand	80	1835
Unrecorded	555	2390
Sand, Thirty-foot? (Gordon Stray) gas, 2410′	25	2415
Unrecorded	10	2425
Gordon sand and unrecorded	115	2540
Fourth sand and unrecorded	93	2633
Fifth sand (McDonald) (oil, 2638′) and unrecorded to bottom	27	2660

Genius Payne† No. 3 Well Record (474).

Located in Ten Mile District, ⅛ mile northeast of Deweytown. Authority, South Penn Oil Company.

(Elevation, 1260′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	503	503
Pittsburgh coal	8	511
Unrecorded	439	950
Sand, Dunkard? (I Cow Run)	25	975
Unrecorded	55	1030
Sand, Big Dunkard	20	1050
Unrecorded	518	1568
Salt sand	112	1680
Unrecorded	103	1783
Red rock	44	1827
Unrecorded	13	1840
"Keener"? (Blue Monday)	22	1862
"Big Lime" (part of Injun)	96	1958
"Injun" sand	47	2005
Unrecorded	195	2200
Sand	25	2225
Unrecorded	195	2420
Sand 10′		
Break 10 **Fifty-foot**	38	2458
Sand 18		
Unrecorded	142	2600

---

*Vol. I, W. Va. Geol. Survey, page 252; 1899.

†Vol. I, W. Va. Geol. Survey, p. 253; 1899.

	Thickness. Feet.	Total. Feet.
Sand, Stray? Thirty-foot? and unrecorded, oil and gas, 2600' 43' Sand, Gordon? Campbell's Run? 17 (Gordon)	60.	2660
Unrecorded	45	2705
Sand, Fourth, and unrecorded	90	2795
Sand, Fifth, McDonald, dry	4	2799
Unrecorded to bottom	40	2839

The identifications in parentheses are by the writer. In this region the top of the Gordon sand comes 2080 to 2100 feet below the Pittsburgh coal, and about 200 feet above the top of the Fifth sand; hence, the changes indicated.

The Genius Payne No. 6 well (472), located ¼ mile to the southeast, was drilled during 1900. It had an initial production of 400 barrels of oil daily from the Fifth sand, and was still making, in July, 1910, 30 barrels weekly.

In the region of Bristol and southwestward between the 400 and 525-foot contours of the Pittsburgh coal bed, as outlined on the map, there occur 15 to 20 gas wells mostly from the Big Injun, Gordon and Fourth sands. The detailed log of the Robinson No. 1 well (459), located 0.4 mile south of Bristol, is published in the Salem section, page 95. It fails, however, to note the horizon at which gas was encountered.

The six following records from this gas region are of special interest:

John Haney No. 1 Well Record (458).

Located in Ten Mile District, ⅞ mile northeast of Bristol. Authority, J. E. Trainer.

(Elevation, 1025' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	480	480
First coal, Redstone and unrecorded	30	510
Pittsburgh coal	10	520
Unrecorded	435	955
Big Dunkard sand and unrecorded	545	1500
Salt sand	60	1560
Unrecorded	180	1740
Blue Monday? (Maxton) sand	100	1840
Unrecorded	20	1860
Big Lime	40	1900
Big Injun sand (gas, 1940')	75	1975
Unrecorded	75	2050

	Thickness. Feet.	Total Feet.
Sand, Hundred-foot (Squaw)	50	2100
Unrecorded	200	2300
Sand, white, (Berea) and unrecorded	60	2360
Sand, white (Gantz), (little gas)	20	2380
Unrecorded	120	2500
Sand, Fifty-foot? (Thirty-foot)	31	2531
Unrecorded	15	2546
Sand, white (Gordon Stray) and unrecorded	43	2589
Sand, Stray? (Gordon)	47	2636
Unrecorded	3	2639
Gordon sand (gas, 2645′) and unrecorded to bottom	26	2665

10″ casing, 135′; 8″ casing, 1080′; 6⅝″ casing, 1860′.

The well starts 30 feet below the Washington coal bed.

Smith-Williams No. 1 Well Record (460).

Located in Ten Mile District, ½ mile south of Bristol. Authority, Philadelphia Company.

(Elevation, 1140′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	741	741
Pittsburgh coal and unrecorded	1943	2684
Sand, Fifty-foot (gas, 2695′)	11	2695
Unrecorded	34	2729
Sand, Forty-foot? (Thirty-foot)	30	2759
Unrecorded	31	2790
Sand, Gordon? (Gordon Stray) (gas, 2796′)	20	2810
Unrecorded	60	2870
Sand, Fourth (gas, 2870′)	5	2875
Unrecorded	136	3011
Sand, Fifth (gas, 3011′)	7	3018

One mile southward, and on the east side of Raccoon run, the Hope Natural Gas Company drilled during 1910 a 10 to 12-barrel daily Maxton sand oil well (461) on the S. S. Cross farm. The well had not been drilled deeper in July, 1910.

Alonzo Rhodes No. 1 Well Record (462).

Located in Ten Mile District, 1¾ miles southeast of Salem. Authority, Trainer Bros. Completed March 23, 1905.

(Elevation, 1130′ B-A. T.)	Thickness. Feet.	Total. Feet.
Conductor	16	16
Unrecorded (water, 40′ and 70′)	616	632
Coal, Mapletown (Redstone)	2	634
Unrecorded	30	664
Coal, Pittsburgh	6	670

	Thickness. Feet.	Total. Feet.
Unrecorded	390	1060
Sand, Little Dunkard (I Cow Run)	15	1075
Unrecorded (no Big Dunkard sand)	363	1438
Sand, First Salt? (II Cow Run)	40	1478
Unrecorded	100	1578
Salt sand	77	1655
Unrecorded	151	1806
Maxton sand	46	1852
Unrecorded	136	1988
Big Lime	54	2042
Break	10	2052
Big Injun sand	85	2137
Unrecorded	278	2415
Berea Grit	30	2445
Unrecorded	77	2522
Sand, soft, Fifty-foot? (Gantz)	22	2544
Unrecorded	77	2621
Sand, Thirty-foot	22	2643
Unrecorded	38	2681
Sand, Gordon Stray	40	2721
Unrecorded	18	2739
Sand, Gordon (gas, 2743′ and 2748′) and unrecorded to bottom	21	2760

10″ casing, 198′; 8¼″ casing, 1203′. Packer set at 2117′.

Dorothy Young No. 1 Well Record (469).

Located in Ten Mile District, 2½ miles southeast of Salem. Authority, Fearless Oil Company.

(Elevation, 1145′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	45	45
Coal, (Washington) and unrecorded	315	360
Coal, (Uniontown), and unrecorded	200	560
Mapletown coal (Sewickley), and unrecorded	80	640
Coal, Pittsburgh, and unrecorded	560	1200
Big Dunkard sand and unrecorded	740	1940
Sand, "Blue Monday"? (Maxton), gas	20	1960
Pencil cave	10	1970
Big Lime	60	2030
Big Injun sand ,gas, 2100′)	110	2140
Unrecorded	325	2465
Sand, gas, Fifty-foot? (Berea) and unrecorded	190	2655
Stray sand (gas)	55	2710
Unrecorded	13	2723
Gordon sand (strong gas)	32	2755
Unrecorded	180	2935
Fifth sand (oil, small)	5	2940
Unrecorded to bottom	10	2950

"Oil filled up 160′ in one hour from Fifth sand."

In the above well, gas is reported at five different horizons; viz., Maxton, Big Injun, Berea, Stray, and Gordon sands.

Leeman Maxwell No. 1 Well Record (476).

Located in Ten Mile District, 1¼ miles west of Deweytown. Authority, Southern Oil Company. Completed Feb. 22, 1901.

(Elevation, 1130' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	650	650
Pittsburgh coal and unrecorded	1960	2610
Gas in Thirty-foot sand		2610
Unrecorded	120	2730
Gas in Gordon sand		2730
Unrecorded	205	2935
Sand, Fifth, gas	9	2944
Unrecorded to bottom	106	3050

10" casing, 162'; 6⅝" casing, 2044'; 3" tubing, 3050'.

Serepta Nutter No. 1 Well Record (477).

Located in Ten Mile District, 1¾ miles west of Deweytown. Authority, Southern Oil Company. Completed Jan. 10, 1902.

(Elevation, 1130' L-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	680	680
Pittsburgh coal and unrecorded	1920	2600
Fifty-foot sand and unrecorded	165	2765
Gordon sand (gas) and unrecorded	206	2971
Fifth sand	5	2976
Unrecorded to bottom	4	2980

6⅝" casing, 2065'.

The southeast border of Ten Mile occupies a high structural level a short distance—2 to 3 miles—down the western slope from the axis of the Wolf Summit anticline; hence, this portion of the district is very prolific gas territory, containing 30 to 40 wells in the region of Wolf Summit and southwestward to Jarvisville. The two following records of wells from this locality give valuable data as to the gas horizons and the volume of the wells:

H. M. Furner No. 1 Well Record (452).

Located in Ten Mile District, ¾ mile southwest of Wolf Summit. Authority, Washington Gas Company. Completed Sept. 3, 1909.

((Elevation, 1165' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	152	152
Coal, Pittsburgh	8	160
Unrecorded	393	553

	Thickness. Feet.	Total. Feet.
Sand, Little Dunkard (I Cow Run)	20	573
Unrecorded	91	664
Big Dunkard sand	35	699
Unrecorded	407	1106
Salt sand	102	1208
Unrecorded	142	1350
Maxton sand	25	1375
Unrecorded	137	1512
Big Lime	55	1567
Big Injun sand	103	1670
Unrecorded	390	2060
Fifty-foot sand	25	2085
Unrecorded	73	2158
Thirty-foot sand (gas)	10	2168
Unrecorded	37	2205
Gordon Stray sand	18	2223
Unrecorded	11	2234
Gordon sand	20	2254
Unrecorded	5	2259
Fourth sand	56	2315
Unrecorded	175	2490
Fifth sand (gas)	30	2520
Slate	18	2538

10" casing, 261'; 6" casing, 1549'; 3" tubing, 2538'.
Packer set in Fifty-foot sand, 471' from bottom of hole."
"Initial production, 3,000,000 feet of gas daily."

The log fails to record the gas horizons.

Copeland Heirs No. 1 Well Record (453).

Located in Ten Mile District, 1.5 miles southwest of Wolf Summit. Authority, Washington Gas Company. Completed Nov. 4, 1909.

(Elevation, 1150' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	160	160
Coal, Pittsburgh	8	168
Unrecorded	372	540
Sand, Little Dunkard (I Cow Run)	35	575
Unrecorded	95	670
Big Dunkard sand	52	722
Unrecorded	153	875
Gas sand	30	905
Unrecorded	5	910
Sand, First Salt (Clarion)	50	960
Unrecorded	66	1026
Salt sand	29	1055
Unrecorded	120	1175
Salt sand	65	1240
(Hole reduced at 1250'; gas at 1340'.)		
Unrecorded	180	1420
Maxton sand	45	1465
Unrecorded	60	1525
Big Lime	75	1600

	Thickness. Feet.	Total. Feet.
Big Injun sand	75	1675
Unrecorded	35	1710
Squaw sand (gas, 1725′)	100	1810
Unrecorded	145	1955
Gantz sand	23	1978
Unrecorded	110	2088
Fifty-foot sand	25	2113
Unrecorded	57	2170
Thirty-foot sand	9	2179
Unrecorded	9	2188
Stray sand	30	2218
Unrecorded	19	2237
Gordon sand	23	2260
Unrecorded	10	2270
Fourth sand	38	2308
Unrecorded	187	2495
Fifth sand	25	2520

10″ casing, 260′; 8″ casing, 1240′; 6⅝″ casing, 1550′; 3″ tubing, 2525′.

"Packer set in Fifty-foot sand, 420′ from bottom of hole."

"Initial daily gas production:

Maxton sand	4,000,000 cubic feet
Big Injun sand	3,000,000 cubic feet
Fifth sand	3,000,000 cubic feet
Total	10,000,000 cubic feet

The above results give a fair idea of the great volume of gas obtained in some of the Harrison county wells.

Prospective Oil and Gas Territory, Ten Mile District.—Ten Mile district has had more wells drilled for oil and gas within its boundaries than in any other in Harrison county. There yet remain, however, a few scattered areas, covering quite a large acreage, that are favored both by structure and present development to warrant further drilling. (1) That portion of the district lying on the head of Grass and Indian runs to the west of the 250-foot contour of the Pittsburgh coal bed as outlined on the structure map accompanying this report, appears very favorable for many more Gordon sand oil wells; (2) that, on the waters of Jacobs run northwest from the present development ½ mile north of Salem, and westward from Salem to the John F. Randolph No. 1 well (426) for Gordon oil; (3) that, on the headwaters of Raccoon and Hall runs, and Coburn fork, 1.5 miles southeast of Salem, would warrant further drilling for gas in the sands below the

Big Injun down to the Fifth; and (4), that, northwest from the mouth of Indian creek to Grass run appears favorable for several more Gordon sand oil wells.

UNION DISTRICT.

Union district occupies the southwestern corner of Harrison county, and its area is traversed in an almost north and south direction by the great Wolf Summit anticline. The extreme eastern border of the district reaches down almost to the axis of the Shinnston Basin near Byron. A glance at the structure map accompanying this report will show that the greater portion of Union has been elevated to a high structural level by the above mentioned anticline, and largely for that reason some of the greatest gas wells ever struck in the State are located within its borders.

The Fifth sand oil pool of Ten Mile district has been extended southwestward along the western border of Union to the Harrison-Lewis county line, and its development will now be considered.

The following record is from a well in this pool at its northeastern end in the district:

L. J. Ayers* No. 1 Well Record (509).

Located in Union District, 0.8 mile southwest of Deweytown. Authority, South Penn Oil Company.

(Elevation, 1410' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	755	755
Pittsburgh coal	6	761
Unrecorded	694	1455
Gas sand (oil show) and unrecorded	570	2025
Maxton sand	55	2080
Unrecorded	120	2200
Big Injun sand	80	2280
Unrecorded	410	2690
Fifty-foot sand	12	2702
Unrecorded	128	2830
Sand, Gordon Stray (gas, 2860')	60	2890
Unrecorded	10	2900
Fourth sand	40	2940
Unrecorded	110	3050
Fifth sand (oil in top)	6	3056

---

*Vol. I (A), W. Va. Geol. Survey, page 321; 1904.

The record shows the Fifth sand coming 2301 feet below the top of the Pittsburgh coal.

In addition to the brief records as given in the table of wells for Harrison county, the more complete logs of the following wells, scattered southwestward along this pool. are published on the pages indicated of Vol. I(A) of the State Survey reports:

Map No.	Name of Well.	Location.	Page of Vol. I (A).
508	Edith Starkey No. 1.......	0.7 mile S. Deweytown.	326
510	Abram Coffindaffer No. 2...	1.2 mile S. 20° W. D'y'n	336
511	Abram Coffindaffer No. 3...	1.6 mile S. 20° W. D'y'n	337
512	A. Mathey No. 3..........	1.1 mile N. Big Isaac..	336
513	F. M. Bailey No. 1.........	1.5 mile N. 30° W. B. I.	337
514	A. Mathey No. 6...........	1 mile N. Big Isaac..	336
515	Stephen Myers No. 1.......	1.5 mile N. 10° W. B. I.	335

Southward from Big Isaac there is an apparent break in the oil pool which comes in again slightly over a mile southward from the latter point on the head-waters of Tanner fork of Kincheloe. Another oil pool occurs 1.5 miles southeastward up the structural slope at the same horizon. It is barely possible that this pool may connect to the northwest with the pool at this horizon on the head of Tenmile creek.

The following is the record of a well on Stutler fork at the north end of the oil pool east of Benson:

F. C. Curry No. 1 Well Record (518).

Located in Union District, 1¼ miles southeast of Big Isaac. Authority, South Penn Oil Company.

(Elevation, 1090′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	840	840
Sand, Dunkard? (Burning Springs)	60	900
Unrecorded	830	1730
Big Lime	50	1780
Big Injun sand	120	1900
Unrecorded	480	2380
Stray sand and unrecorded	10	2390
Gordon sand (gas, 2440′)	62	2452
Unrecorded	166	2618
Fifth sand (oil)	5	2623
Unrecorded to bottom	27	2650

The Pittsburgh coal belongs at about 265 feet in the well; hence, the sand at 840 feet must correlate with the Burning Springs (Upper Freeport).

The detailed log of the J. M. Hall No. 1 well (522), located one mile due east of Benson, is published in connection with the section for the latter place, page 102.

The two following records are from wells in this pool near the Harrison-Lewis county line:

Crocker-Hall No. 1 Well Record (523).

Located in Union District, 1¼ miles South 60° East of Benson. Authority, Reserve Gas Company.

(Elevation, 1065' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1635	1635
Big Injun sand	147	1782
Unrecorded (gas in Thirty-foot sand)	436	2218
Sand, Gordon? (Stray and Gordon)	92	2310
Unrecorded	136	2446
Fifth sand (gas)	14	2460
Unrecorded to bottom	2	2462

W. L. Hall No. 3 Well Record (525).

Located in Union District, 0.9 mile southeast of Benson. Authority, South Penn Oil Company.

(Elevation, 1050' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1752	1752
Big Injun sand	96	1848
Unrecorded	522	2370
Gordon sand	51	2421
Unrecorded	149	2570
Fifth sand (oil to bottom)	6	2576

The axis of the Wolf Summit anticline enters Union district from the north, 2.5 miles south about 15° west from Wilsonburg, and along the crest of this fold, and 1 to 4 miles down each slope there occurs a large number of heavy gassers mostly in the Catskill sandstone group.

The three following records are from wells in this field:

Sanford Fleming No. 1 Well Record (480).

Located in Union District, 2¾ miles south of Wilsonburg. Authority, Reserve Gas Company.

(Elevation, 1200' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1435	1435
Big Injun sand	120	1555
Unrecorded (**gas in Thirty-foot sand**)	635	2190
Gordon sand	30	2220
Unrecorded	110	2330
Fifth sand (**gas**)	21	2351
Unrecorded to bottom	267	2618

Well starts 15 feet below the Pittsburgh coal.

Haymond Maxwell No. 1 Well Record (483).

Located in Union District, 3 miles east of Jarvisville. Authority, Reserve Gas Company.

(Elevation, 1155' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1400	1400
Big Injun sand	110	1510
Unrecorded (**gas in Thirty-foot sand**)	583	2093
Gordon sand	52	2145
Unrecorded	125	2270
Fifth sand (**gas**)	15	2285
Unrecorded to bottom	57	2342

The well is located nearly on the axis of the Wolf Summit anticline, and it starts about 75 feet below the Pittsburgh coal bed.

W. B. Maxwell No. 2005 Well Record (484).

Located in Union District, 2½ miles east of Jarvisville. Authority, Philadelphia Company.

(Elevation, 1017' L-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	290	290
Coal (Brush Creek) and unrecorded	36	326
Big Dunkard sand	34	360
Unrecorded	155	515
Gas sand	30	545
Unrecorded	430	975
Sand, Maxton? (Salt)	70	1045
Unrecorded	240	1285
Big Injun sand (gas, 1290')	100	1385
Unrecorded	425	1810
Thirty-foot sand (gas pay, 1815'-1825')	25	1835

The well starts about 190 feet below the Pittsbugrh coal bed; hence, the coal at 290 feet correlates with the Brush Creek of the Conemaugh series.

Three miles southeastward, and just east from the axis of the Wolf Summit Arch, there occurs a group of 18 to 20 gas wells surrounding West Milford. The detailed log of G. W. Wolf No. 1 well (487) from this group, is published in connection with the West Milford section, page 100. This well had been abandoned in August, 1910, and at that time was burning in a large flame from the well mouth, the fire having made a considerable excavation. The gas comes from the Fifty-foot.

The following record is from another gasser in this group, located 0.3 mile west of the Wolf well. It starts 16 feet by hand-level below the Pittsburgh coal bed, and its record serves as a check on the correlations of the West Milford section, page 100.

Harvey Heffner No. 2038 Well Record (488).

Located in Union District, 0.5 mile north of West Milford. Authority, Philadelphia Company. Completed August 12, 1910.

(Elevation, 1175' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	550	550
Sand, Big Dunkard? (Burning Springs)	86	636
Unrecorded	104	740
Sand, Salt? (Clarion)	25	765
Unrecorded	55	820
Salt sand (water, 995')	205	1025
Unrecorded	125	1150
Sand, Maxton? (Salt)	70	1220
Unrecorded	208	1428
Pencil cave	12	1440
Big Lime	90	1530
Big Injun sand	120	1650
Squaw sand	80	1730
Unrecorded	260	1990
Sand, Thirty-foot (50-ft.) (gas, 2010')	80	2070
Unrecorded	10	2080
Sand, Stray (30-ft.)	16	2096
Unrecorded	10	2106
Sand, Gordon Stray	34	2140
Unrecorded	120	2260
Fourth sand	6	2266
Unrecorded	147	2413
Fifth sand	7	2420

	Thickness. Feet.	Total. Feet.
Slate to bottom	19	2439

"Pressure to the square inch in 6⅝" casing (50-ft. sand):
5th minute, 8 lbs. 30th minute, 70 lbs.
10th minute, 16 lbs. Rock pressure, 135 lbs.
"Pressure to the square inch in 3" tubing (5th sand?):
1st minute, 5 lbs. 15th minute, 110 lbs.
5th minute, 25 lbs. 30th minute, 230 lbs.
10th minute, 60 lbs. Rock pressure (24 hrs.), 800 lbs.

The three following records are from Union district wells, located on the western slope of the Wolf Summit anticline. All are gassers in the Fifth sand, and at other higher horizons in the Catskill sandstone series. The first two contain interesting data as to gas pressure in this locality:

Nancy Nicholson No. 1979 Well Record (494).

Located in Union District, 1½ miles S. 10° W. of Jarvisville. Authority, Philadelphia Company. Completed Nov. 22, 1909.

(Elevation, 1155' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	230	230
Pittsburgh coal	5	235
Unrecorded	395	630
Sand, Little Dunkard (I Cow Run)	20	650
Unrecorded	270	920
Sand, Big Dunkard ("Gas")	70	990
Unrecorded	64	1054
Sand, Salt (II Cow Run and Salt)	244	1298
Unrecorded	56	1354
Sand, Maxton? (Salt)	36	1390
Unrecorded	250	1640
Big Lime	46	1686
Big Injun sand	70	1756
Unrecorded	358	2114
Fifty-foot sand	63	2177
Thirty-foot sand	20	2197
Unrecorded	53	2250
Gordon Stray sand	40	2290
Unrecorded	20	2310
Gordon sand (gas, 2354')	44	2354
Unrecorded	4	2358
Fourth sand	36	2394
Unrecorded	143	2537
Fifth sand (gas, 2538')	6	2543
Unrecorded to bottom	40	2583

10" casing, 236'; 8¼" casing, 1562'; 6⅝" casing, 2019'; 3" tubing (2589')?

Pressure test to the square inch in 3" tubing:
1st minute, 80 lbs. 15th minute, 490 lbs.
5th minute, 240 lbs. 30th minute, 620 lbs.
10th minute, 390 lbs. Rock pressure (48 Hrs.), 780 lbs.

I. C. Bennett No. 1 Well Record (495).

Located in Union District, 1.5 miles south of Jarvisville. Authority, Washington Gas Company.

(Elevation, 1160' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	220	220
Coal, Pittsburgh	6	226
Unrecorded	424	650
Sand, Little Dunkard (I Cow Run)	25	675
Unrecorded	155	830
Sand, "Gas"? (Burning Springs)	25	855
Unrecorded	55	910
Sand, "Second Gas"? ("Gas")	95	1005
Unrecorded	45	1050
Sand, First Salt? (II Cow Run)	20	1070
Unrecorded	50	1120
Salt sand	40	1160
Unrecorded	40	1200
Salt sand	160	1360
Unrecorded	100	1460
Red rock	67	1527
Maxton sand (heavy salt water, 1545')	95	1622
Unrecorded	5	1627
Big Lime	65	1692
Big Injun sand	97	1789
Unrecorded	231	2020
Sand, Gantz? (Berea)	25	2045
Unrecorded	92	2137
Fifty-foot sand	23	2160
Unrecorded	78	2238
Thirty-foot sand	17	2255
Unrecorded	5	2260
Stray sand	45	2305
Unrecorded	10	2315
Gordon sand (gas, 2322')	74	2389
Unrecorded	20	2409
Fourth sand	10	2419
Unrecorded	125	2544
Fifth sand (gas, 2546')	8	2552
Unrecorded to bottom	9	2561

10" casing, 320'; 8¼" casing, 765'; 6⅝" casing, 1630'; 5" casing, 2356'.

Rock pressure to the square inch in Gordon sand, 900 lbs.

Rock pressure to the square inch in Fifth sand, 750 lbs.

The above results are unusual, in that the deeper sand usually has the higher rock pressure. The exception in this case is no doubt largely due to the many Fifth sand gassers to the north and eastward, all of which have tended to lower the original pressure at this horizon.

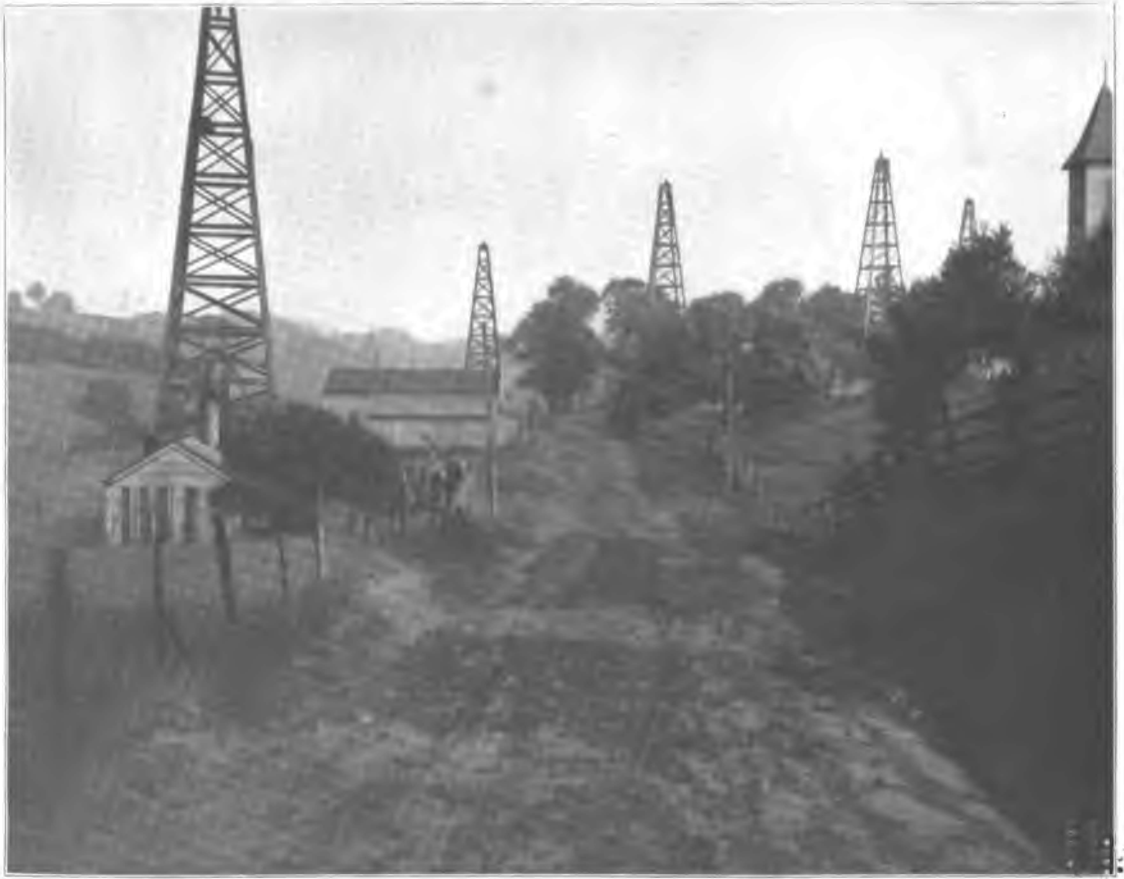


PLATE XV.—View looking north from Adamsville, showing Proximity of Oil Wells on Coons run, and Topography of Monongahela series.

W. B. Brown No. 1588 Well Record (496).

Located ¾ mile northwest of Tichenal, Union District. Authority, Hope Natural Gas Company.

(Elevation, 1170′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1696	1696
Big Injun sand	104	1800
Unrecorded, gas in Gantz and Fifty-foot sands	541	2341
Sand, Gordon? (Fourth)	32	2373
Unrecorded	21	2494
Sand, Fifth (gas)	9	2503
Unrecorded to bottom	10	2513

The well starts 135 feet by aneroid above the base of the Pittsburgh coal bed.

One mile northwest of Goodhope, there is found one of the largest gas wells ever drilled in the State. This is the Jacob McConkey No. 1 well (498), the detailed record of which, including volume and rock pressure, is published in connection with the Goodhope section, page 103. The well is located slightly over a mile west of the axis of the Wolf Summit anticline.

The three following records are from wells located a short distance west of the crest of the above mentioned anticline, in the southeast portion of Union district:

W. S. Burnside No. 1 Well Record (500).

Located in Union District, in Goodhope. Authority, Hope Natural Gas Company.

(Elevation, 1015′ L-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	70	70
Native coal, (Harlem)	4	74
Unrecorded	91	165
Coal (Brush Creek)	5	170
Unrecorded	71	241
Sand, Little Dunkard? (Big Dunkard)	40	281
Unrecorded	94	375
Sand, Big Dunkard? (Burning Springs)	23	398
Unrecorded	107	505
Coal, (Lower Kittanning)	2	507
Unrecorded	5	512
Gas? sand (Clarion)	60	572
Unrecorded	35	607
Sand, First Salt? (II Cow Run)	55	662
Coal, (Tionesta)	2	664

	Thickness. Feet.	Total. Feet.
Unrecorded	62	722
Salt sand	58	780
Unrecorded	75	855
Sand, Maxton? (Salt)	45	900
Unrecorded	125	1025
Red rock	13	1038
Unrecorded	124	1162
Little lime	8	1170
Pencil cave	25	1195
Big Lime (gas, 1210'; oil, 1212')	77	1272
Big Injun sand.		

10" casing, 349'; 8¼" casing, 709'; 6⅝" casing, 1281'.

The well starts 250 to 260 feet below the Pittsburgh coal bed.

William Gaston No. 1 Well Record (501).

Located in Union District, 2¾ miles southwest of Goodhope. Authority, Hope Natural Gas Company.

(Elevation, 1090' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1669	1669
Big Injun sand	80	1749
Unrecorded (gas in Gantz and Stray sands)	543	2292
Gordon sand	20	2312
Unrecorded	103	2415
Fifth sand (gas) to bottom	14½	2429½

The well starts 55 feet above the base of the Redstone coal.

C. C. Tallman* No. 1 Well Record (504).

Located in Union District, at Mineral. Authority, Hope Natural Gas Company.

(Elevation, 994' L-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	575	575
Sand, Big Dunkard? (Burning Springs)	60	635
Unrecorded	205	840
Sand, Salt? (II Cow Run and Salt)	135	975
Unrecorded	490	1465
Big Lime	80	1545
Big Injun sand	90	1635
Unrecorded	175	1810
Berea sand	25	1835
Unrecorded	130	1965
Fifty-foot sand (gas, 1985')	25	1990
Unrecorded	25	2015

---

*Vol. I (A), W. Va. Geol. Survey, p. 333; 1904.

	Thickness. Feet.	Total. Feet.
Sand, Stray? (30-ft. and Stray)	75	2090
Unrecorded	10	2100
Gordon sand (gas, 2120')	35	2135
Unrecorded	175	2310
Fifth sand (gas, 2315')	10	2320
Unrecorded to bottom	65	2385

The well starts flush with the base of the Pittsburgh coal bed.

In the extreme southeast corner of the district, the Hope Natural Gas Company drilled the Arthur Rhodes No. 2 well (506), in which gas is reported in the Gantz sand. The well starts 25 feet below the Ames limestone, and its brief record is given in the table of wells for Harrison county.

Prospective Oil and Gas Territory, Union District.—While a large number of wells have been drilled in Union district, yet, there still remains a large acreage that would warrant further test wells. This is especially true as regards gas, since the central and eastern portions of the district occupies a high structural level as compared to the western border of Harrison county. (1) That portion of the district immediately northeast of Benson and northwest of the J. M. Hall No. 1 well (522) may hold the connecting pool to the Fifth sand oil field on the head-waters of Tanner fork of Kincheloe creek; (2) that, along the line joining Frank C. Curry No. 1 well (518), 1.3 miles southeast of Big Isaac, to the J. T. Somerville No. 2 well (313), 0.5 mile northeast of Big Isaac, appears good for gas with a chance of Fifth sand oil; (3) that, southwestward from Isaacs creek to Kincheloe creek, and eastward to the West Fork river from the 1000-foot contour of the Pittsburgh coal bed as outlined on the map, for gas in the Fifty-foot, Gordon, and Fifth sands; (4) that, north and northeast of Tichenal to Buffalo creek, for gas at the same horizons; (5) that, southward along the axis of the Wolf Summit anticline as outlined on the economic geology map accompanying this report from Sycamore creek to its first intersection with West Fork river, for gas; and (6) all that portion of the district east of a north and south line through West Milford, for gas.

EAGLE DISTRICT.

Eagle district occupies the north central portion of Harrison county, and its area is traversed in a northeast-southwest direction by the Wolf Summit anticline, the latter fold therein having more or less of a dome structure. Its northwest corner reaches almost to the axis of the Robinson Basin, while its extreme eastern point barely reaches the axis of the Shinnston Basin. A glance at the structure map accompanying this report will show that much relief prevails in the district, in that the Pittsburgh coal bed has been elevated by the Wolf Summit Arch from 175 feet above tide 2 miles west of Margaret, to 1175 feet above tide, 2 miles westward from Lumberport, or a range in elevation of 1000 feet; hence, conditions are ideal from a structure standpoint for the segregation of its oil and gas into pools of commercial value.

Five separate oil pools occur in the district, two of which are in the Fourth sand, one in the Gordon; one in the Gordon Stray, and the other in the Thirty-foot sand. One of the Fourth sand pools is located one mile west of Shinnston, and the other, near the head of Lambert run. The Gordon pool is located in the northwestern corner of the district; the Thirty-foot pool near Margaret, and the Gordon Stray, south and east of Margaret.

A great gas field at several different horizons occurs along the crest of the Wolf Summit anticline, and 2 to 4 miles down the adjacent slopes of the latter fold. The oil and gas development in the district will now be considered from the northwest to southeast.

In the northwest corner of Eagle district, there occurs a pool of 35 to 40 Gordon sand oil wells. The seven following records are from wells in this locality:

H. S. Davis No. 1 Well Record (532).

Located in Eagle District, 1¼ miles N. 80° W. of Margaret. Authority, South Penn Oil Company. Completed July 6, 1904.

(Elevation, 1140′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	865	865
Coal, Pittsburgh	5	870

	Thickness. Feet.	Total. Feet.
Unrecorded	420	1290
Sand, Dunkard? (I Cow Run) (oil, 1306')	61	1351
Unrecorded	360	1711
Sand, Salt? (II Cow Run and Salt)	214	1925
Unrecorded	75	2000
Maxton sand	20	2020
Unrecorded	80	2100
Big Lime	50	2150
Big Injun sand	109	2259
Unrecorded	501	2760
Fifty-foot sand	20	2780
Unrecorded	60	2840
Thirty-foot sand	30	2870
Unrecorded	50	2920
Sand, Stray (Gordon Stray)	53	2973
Unrecorded	15	2988
Sand, Gordon (oil, 3003') and unrecorded to bottom	24	3012

10" casing, 356'; 8¼" casing, 1457'; 6⅝" casing, 1926'; 5 3/16" casing, 2845'.

In addition to a Gordon sand production, a showing of oil is reported in the I Cow Run sand.

Simon S. Shriver No. 2 Well Record (533).

Located in Eagle District, 1.1 miles west of Margaret. Authority, South Penn Oil Company. Completed Nov. 15, 1904.

(Elevation, 1160' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	860	860
Coal, Pittsburgh	5	865
Unrecorded	500	1365
Sand, Dunkard (Big Dunkard)	105	1470
Unrecorded	330	1800
Salt sand	200	2000
Unrecorded	85	2085
Big Lime	40	2125
Big Injun sand	115	2240
Unrecorded	510	2750
Fifty-foot sand	35	2785
Unrecorded	90	2875
Stray sand	70	2945
Unrecorded	9	2954
Gordon sand (oil, 2962')	44	2998
Unrecorded to bottom	28	3026

Conductor, 16'; 10" casing, 270'; 8¼" casing, 1282'; 6⅝" casing, 2508'.

J. E. Copenhaver No. 1 Well Record (534).

Located in Eagle District, ¾ mile S. 70° W. of Margaret. Authority, South Penn Oil Company. Completed March 13, 1904.

(Elevation, 1160' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1080	1080

	Thickness. Feet.	Total. Feet.
Coal, Pittsburgh	5	1085
Unrecorded	475	1560
Sand, Dunkard (Big Dunkard)	56	1616
Unrecorded	349	1965
Sand, Salt	80	2045
Unrecorded	220	2265
Big Lime	80	2345
Sand, Big Injun	100	2445
Unrecorded	490	2935
Sand, Fifty-foot? (30-ft.)	25	2960
Unrecorded	140	3100
Stray sand	50	3150
Unrecorded	10	3160
Gordon sand (gas, 3183')	28	3188
Unrecorded to bottom	49	3237

10" casing, 336'; 8¼" casing, 1866'; 6⅝" casing, 2759'.

Cena Copenhaver No. 1 Well Record (540).

Located in Eagle District, 1 mile southwest of Margaret. Authority, South Penn Oil Company. Completed May 23, 1908.

(Elevation, 1135' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	750	750
Coal, Pittsburgh	5	755
Unrecorded	349	1104
Sand, Little Dunkard? (Moundsville and I Cow Run)	116	1220
Unrecorded	60	1280
Big Dunkard sand	20	1300
Unrecorded	200	1500
Sand, Gas? (II Cow Run) (gas pay, 1600'-1604' to bottom	104	1604

Conductor, 8'; 10" casing, 170'; 8¼" casing, 1288'.
"Gas test, 18/10 water in 8¼" casing."

This test is equivalent to a gas volume of 3,400,000 cubic feet daily from the II Cow Run sand, the largest flow observed at this horizon in the Doddridge-Harrison area.

C. L. Starkey No. 1 Well Record (541).

Located in Eagle District, 1¼ miles southwest of Margaret. Authority, South Penn Oil Company. Completed June 23, 1909.

(Elevation, 1105' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded (steel line)	770	770
Coal, Pittsburgh	6	776
Unrecorded	418	1194
Sand, Little Dunkard (I Cow Run)	26	1220
Unrecorded	65	1285

	Thickness. Feet.	Total. Feet.
Big Dunkard sand	50	1335
Unrecorded	300	1635
Salt sand	225	1860
Unrecorded	55	1915
Maxton sand	25	1940
Unrecorded	30	1970
Big Lime	20	1990
Unrecorded	60	2050
Big Injun sand	120	2170
Unrecorded	468	2638
Fifty-foot sand (gas, 2652′)	42	2680
Unrecorded	55	2735
Thirty-foot sand	20	2755
Unrecorded	54	2809
Stray sand	57	2866
Unrecorded	10	2876
Gordon sand	39	2915
Unrecorded to bottom	91	3006

Conductor, 12′; 10″ casing, 147′; 8¼″ casing, 1285′; 6⅝″ casing, 2010′; 5$\frac{3}{16}$″ casing, 2665′.

(Enoch) C. L. Starkey No. 2 Well Record (542).

Located in Eagle District, 1.5 miles southwest of Margaret. Authority, South Penn Oil Company.

	Thickness. Feet.	Total. Feet.
Unrecorded	1079	1079
Coal, Pittsburgh	3	1082
Unrecorded	1237	2319
Big Lime	44	2363
Big Injun sand	117	2480
Unrecorded	628	3108
Stray sand	52	3160
Unrecorded	18	3178
Gordon sand (oil pay, 3196′)	39	3217
Unrecorded to bottom	13	3230

(H. S.) Sarah Davis No. 1 Well Record (543).

Located in Eagle District, 1.5 miles southwest of Margaret. Authority, Carnegie Natural Gas Company.

(Elevation, 1270′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	860	860
Coal, Pittsburgh	5	865
Unrecorded	1365	2230
Big Injun sand (gas, 2240′)		

10″ casing, 160′; 8¼″ casing, 1385′; 6⅝″ casing, 2205′; 3″ tubing, 2269′.

"Rock pressure, 500 lbs to the square inch."

The two following records are from the Thirty-foot sand pool at Margaret and to the northeast in the edge of Marion county:

Serena Wyer No. 1 Well Record (535).

Located in Eagle District, at Margaret. Authority, South Penn Oil Company. Completed Sept. 13, 1909.

(Elevation, 1025′ B-A. T.)	**Thickness. Feet.**	**Total. Feet.**
Unrecorded	595	595
Coal, Pittsburgh (steel line)	6	601
Unrecorded	279	980
Sand, Little Dunkard (Grafton)	26	1006
Unrecorded	19	1025
Sand, Big Dunkard? (I Cow Run)	25	1050
Unrecorded	500	1550
Salt sand	35	1685
Unrecorded	85	1770
Maxton sand	25	1795
Unrecorded	67	1862
Big Lime	51	1913
Big Injun sand	125	2038
Unrecorded	479	2517
Fifty-foot sand	36	2553
Unrecorded	36	2589
Thirty-foot sand (oil pay, 2590′)	8	2607
Unrecorded	69	2676
Stray sand	76	2732
Unrecorded	10	2742
Gordon sand	40	2782
Unrecorded to bottom	7	2789

10″ casing, 212′; 8¼″ casing, 1030′; 6⅝″ casing, 1872′; 5 3/16″ casing, 2519′.

Isabel Moore No. 1 Well Record (537).

Located ½ mile east of Margaret in Mannington District, Marion County. Authority, Carnegie Natural Gas Company.

(Elevation, 1065′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	617	617
Coal, Pittsburgh	6	623
Unrecorded	1295	1918
Big Injun sand	142	2060
Unrecorded	380	2440
Gantz sand	30	2470
Unrecorded	80	2550
Fifty-foot sand	30	2580
Unrecorded	37	2617
Thirty-foot sand (oil)	13	2630
Unrecorded to bottom	10	2640

10″ casing, 230′; 8¼″ casing, 1070′; 6⅝″ casing, 1870′.

"Initial production, 5 barrels daily from 30ft."

The two following records are from wells in the Gordon Stray sand a short distance east and south from Margaret:

L. V. Morris No. 1 Well Record (536).

Located in Eagle District, ½ mile southeast of Margaret. Authority, South Penn Oil Company.

(Elevation, 1030′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	885	885
Sand, Little Dunkard (Grafton)	25	910
Unrecorded	105	1015
Sand, Big Dunkard? (I Cow Run)	15	1030
Unrecorded	270	1300
Gas sand	80	1380
Unrecorded	85	1465
Salt sand	180	1645
Unrecorded	83	1728
Maxton sand	22	1750
Unrecorded	50	1800
Little lime	15	1815
Unrecorded	5	1820
Big Lime	36	1856
Big Injun sand	145	2001
Unrecorded	471	2472
Fifty-foot sand	13	2485
Unrecorded	67	2552
Thirty-foot sand 13′		
Unrecorded 23 } "30-ft."	58	2610
Boulder sand 22		
Unrecorded	20	2630
Stray sand (oil, 2559′)	55	2685
Unrecorded	6	2691
Gordon sand	19	2710
Unrecorded	50	2760
Fourth sand	10	2770
Unrecorded	112	2882
Fifth sand	6	2888
Unrecorded to bottom	172	3060

The oil sand in the above well comes over 70 feet deeper below the top of the Big Injun sand than the oil sand in the Wyer and Moore wells (535 and 537) given above; hence, the pay streak occurs in the Gordon Stray.

Sarah A. Baker No. 1 Well Record (539).

Located in Eagle District, 1.1 miles S. 30° W. of Margaret. Authority, South Penn Oil Company. Completed April 1, 1909.

(Elevation, 1300′ L-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	858	858
Coal, Pittsburgh	4	862

	Thickness. Feet.	Total. Feet.
Unrecorded	346	1208
Sand, Little Dunkard? (Moundsville)	20	1228
Unrecorded	72	1300
Sand, Big Dunkard? (I Cow Run)	13	1313
Unrecorded	367	1680
Sand, Salt? (II Cow Run and Salt)	280	1960
Unrecorded	120	2080
Maxton sand	10	2090
Unrecorded	20	2110
Big Lime	60	2170
Big Injun sand	145	2315
Unrecorded	542	2857
Thirty-foot sand	12	2869
Unrecorded	76	2945
Stray sand (oil pay, 2865′)	38	2983
Unrecorded	4	2987
Sand, **Gordon** 7′ } (Gordon)	26	3013
Unrecorded 9		
Sand, Second Gordon 10		
Unrecorded to bottom	277	3290

Conductor, 16′; 10″ casing, 150′; 8¼″ casing, 1313′; 6⅝″ casing, 2100′; 5$\frac{3}{16}$″ casing, 2869′.

The rocks rise very rapidly southeastward from Margaret on the western slope of the Wolf Summit anticline; hence, on Bingamon creek, in the region of Grangeville, there occurs a great gas field in several different sands. The six following records of wells in Eagle district on the waters of Bingamon creek, give much valuable data as to volume, pressure, and gas horizons:

Daniel F. Cunningham No. 1 Well Record (544).

Located in Eagle District, 1¼ miles east of Margaret. Authority, South Penn Oil Company. Completed May 30, 1904.

(Elevation, 1010′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	782	782
Coal, Pittsburgh (steel line)	5	787
Unrecorded	463	1250
Sand, Dunkard (Big Dunkard)	100	1350
Unrecorded	330	1680
Salt sand	100	1780
Unrecorded	225	2005
Big Lime	65	2070
Big Injun sand	110	2180
Unrecorded	500	2680
Fifty-foot sand	20	2700
Unrecorded	76	2776
Stray sand	84	2860

	Thickness. Feet.	Total. Feet.
Unrecorded	6	2866
Gordon sand (gas, 2902')	100	2966
Unrecorded to bottom	406	3372

10" casing, 281'; 8¼" casing, 1186'; 6⅝" casing, 2192'.

B. F. Griffin No. 1 Well Record (551).

Located in Eagle District, ¾ mile south of Grangeville. Authority, Carnegie Natural Gas Company. Completed April 19, 1910.

	Thickness. Feet.	Total. Feet.
Unrecorded	485	485
Pittsburgh coal	10	495
Unrecorded	1305	1800
Big Injun sand	150	1950
Unrecorded	310	2260
Sand, Gantz? (Berea)	30	2290
Unrecorded	108	2398
Fifty-foot sand (gas, 2397')	45	2443
Unrecorded	33	2476
Thirty-foot sand (gas, 2377')	15	2491

10" casing, 500'; 8¼" casing, 1006'; 6⅝" casing, 1400'.

"Pressure, open flow: 0.4" mercury in 6⅝" pipe."

The pressure test shows the well to have a volume of 3,850,000 cubic feet daily.

Daniel E. Shaw No. 1 Well Record (552).

Located in Eagle District, 1¾ miles southeast of Margaret. Authority, Carnegie Natural Gas Company. Completed Jan. 25, 1909.

(Elevation, 1285' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	670	670
Pittsburgh coal	8	678
Unrecorded	1283	1961
Big Injun sand (gas, 1973', 1991', and 2438')	135	2096
Unrecorded	477	2573
Sand, Gantz? (Fifty-foot) (gas, 2610')	52	2625
Unrecorded	23	2648
Sand, Fifty-foot? (Thirty-foot)	22	2670
Unrecorded	25	2695
Gordon Stray sand	112	2807
Gordon sand	33	2840
Unrecorded	15	2855
Fourth sand	8	2863
Unrecorded	117	2980
Fifth sand to bottom	6	2986

10" casing, 310'; 8¼" casing, 1164'; 6⅝" casing, 1939'; 3" tubing, 1956'.

Pressure to the square inch in 3" tubing: 1st minute, 75 lbs.; rock pressure, 650 lbs.

The gas pay at 2610 feet occurs in the Fifty-foot instead of the Gantz as given by the driller, since the former sand belongs 450 to 480 feet below the Big Injun sand.

Odell V. Ashcraft No. 2117 Well Record (555).

Located in Eagle District, 1¼ miles west of Sturms Mill. Authority, Philadelphia Company. Completed Sept. 26, 1906.

(Elevation, 1170′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	280	280
Pittsburgh coal	8	288
Unrecorded	1312	1600
Big Lime	65	1665
Big Injun sand (gas, 1775′; break, 1765′-1770′)	125	1790
Unrecorded	410	2200
Fifty-foot sand	50	2250
Unrecorded	220	2470
Gordon sand	15	2485
Unrecorded	5	2490
Fourth sand	15	2505
Unrecorded (gas, 2537′)	146	2651
Fifth sand (gas, 2654′)	3	2654
Unrecorded to bottom	62	2716

10″ casing, 320′; 8¼″ casing, 1065′; 6⅝″ casing, 1615′; 3″ casing, 2227′.

"Pressure test to the square inch in (3″?) pipe:

1st ¼ minute,	25 lbs.	10th minute,	170 lbs.
1st minute,	40 lbs.	15th minute,	230 lbs.
2nd minute,	60 lbs.	30th minute,	340 lbs.
5th minute,	110 lbs.	Rock pressure,	670 lbs.

Wm. Chalfant No. 1878 Well Record (559).

Located in Eagle District, ¼ mile south of Peora. Authority, Philadelphia Company. (Elevation,, 1190′ L-A.T.). 2536 ft. of 3″ tubing.

Pressure to the sq. inch in 3″ tubing on Aug. 4, 1910:

1st ½ minute,	15 lbs.	10th minute,	130 lbs.
1st minute,	25 lbs.	15th minute,	167 lbs.
2nd minute,	43 lbs.	30th minute,	225 lbs.
5th minute,	83 lbs.	Rock pressure,	355 lbs.

The writer failed to obtain the log of this well, but the Pittsburgh coal belongs at about 150 feet in depth in the well, which, along with the length (2536 feet) of 3″ tubing used, is evidence that the test is for Fifth sand gas. It is also reported a gasser in the Big Injun.

James Coffman No. 1 Well Record (564).

Located in Eagle District, 2 miles N. 85° W. of Peora. Anthority, Fairmont and Grafton Gas Company.

(Elevation, 1085' B-A.T.	Thickness Feet.	Total Feet.
Unrecorded	97	97
Pittsburgh coal and unrecorded	1419	1516
Big Injun sand (gas, 1520')	42	1558
Unrecorded	292	1850
Berea sand, grayish white (gas, 1852')	2	1852
Unrecorded	116	1968
Fifty-foot sand (shell) and unrecorded	337	2306
Fourth sand	16	2321
Unrecorded (no Fifth sand)	147	2478
Sand, Bayard? (Fifth) (gas, 2480')	7	2485

"Sand, dark and full of white pebbles. Drilled to 2808 feet, but found no more sand below the Bayard. The formation was composed of white and black slate and a few thin limy shells. Small gas well; good for a million feet."

The record and data are republished from page 328 of Vol. I(A) of the State Survey reports to correct errors of correlation. The true Bayard sand belongs 100 feet lower than the sand at 2478 feet; hence, the latter represents the Fifth sand. This well has been drilled several years as is evident from the last sentence of the above quotation.

J. B. Cunningham No. 1 Well Record (563).

Located in Eagle District, 0.9 mile southwest of Wyatt. Authority, T. B. Peddicord, Foreman, Fairmont & Grafton Gas Company. Completed about 1890.

(Elevation, 1000' B-A. T.)	Thickness. Feet.	Total. Feet.
Slate and lime	140	140
Slate	60	200
Red rock (Pittsburgh)	100	300
Slate	40	340
Gray sand, Little Dunkard? salt water (Moundsville)	50	390
Slate	32	422
Sand, (Big Dunkard)	130	552
Slate	136	688
White sand (Gas sand)	78	766
Coal, (Clarion)	8	774
Slate	26	800
Sand, (II Cow Run)	35	835
Slate	40	875
Sand, (Salt)	191	1066
Slate	4	1070
Sand	20	1090

		Thickness. Feet.	Total. Feet.
Slate		32	1122
Sand		38	1160
Red rock		85	1245
White slate		8	1253
Lime, (Big Lime)		112	1365
Sand	65′		
Slate	37	(Big Injun) 124	1489
Sand, "Mannington Oil"	22		
Slate		359	1848
Sand, (Berea)		8	1856
Slate		44	1900
Sand (Gantz)		18	1918
Slate		2	1920
Sand, hard (Fifty-foot)		48	1968
Slate		20	1988
Sand		12	2000
Black sand and slate		35	2035
Red rock		23	2058
Sand, white, (Thirty-foot gas)		32	2090
Red rock		70	2160
Sand, gray, (Gordon Stray)		13	2173
Black slate		16	2189
Gordon sand (big gas)		11	2200
Slate		15	2215
Gray sand (Fourth)		13	2228
Slate to bottom		148	2376

"Producing in August, 1904, (13 or 14 years after completion), 800,000 cu. ft. of gas daily. Rock pressure, same date, 450 lbs."

The well starts 10 feet below the Pittsburgh coal. The identifications in parentheses are by the writer.

Jones creek flows in a southeast direction almost entirely across Eagle district, and intersects the Wolf Summit anticline near the summit of the structural dome in this fold; hence, the area drained by this stream is a great gas field on which a large number of producing wells have already been drilled. The seven following records from wells on this creek, give much valuable data:

Harriet A. Michael No. 2342 Well Record (565).

Located in Eagle District, 2.3 miles southwest of Grangeville. Authority, Philadelphia Company. Completed May 16, 1910.

(Elevation, 1160′ B-A.T.)	Thickness Feet.	Total Feet.
Unrecorded	562	562
Coal, Freeport? (Pittsburgh)	6	568
Unrecorded	662	1230
Sand, Salt	35	1265

	Thickness. Feet.	Total. Feet.
Unrecorded	50	1315
Salt sand	130	1445
Unrecorded	30	1475
Salt sand (water, 1510')	150	1625
Unrecorded	210	1835
Big Lime	63	1898
Big Injun sand (gas, 1898') and unrecorded to bottom	112	2010

10" casing, 209'; 8¼" casing, 1130'; 6⅝" casing, 1863'; 3" tubing, 2004'.

Pressure in lbs. to the sq. inch:

May 16, 1910, in 6⅝" casing.		Nov. 1, 1910, in 3" tubing.	
1st ½ minute,	20 lbs.	1st ½ minute,	180 lbs.
1st minute,	40 lbs.	1st minute,	260 lbs.
2nd minute,	85 lbs.	5th minute,	390 lbs.
5th minute,	180 lbs.	10th minute,	405 lbs.
10th minute,	253 lbs.	20th minute,	415 lbs.
15th minute,	285 lbs.	30th minute,	425 lbs.
30th minute,	315 lbs.	Rock pressure,	455 lbs.
Rock pressure,	340 lbs.		

B. F. Heldreth No. 1 Well Record (568).

Located in Eagle District, 2 miles northwest of Jimtown. Authority, Carnegie Natural Gas Company. Completed Dec. 31, 1908.

(Elevation, 1080' B-A.T.)	Thickness. Feet.	Total. Feet.
Unrecorded	340	340
Pittsburgh coal	5	345
Unrecorded	1315	1660
Big Injun sand (gas, 1672'-1678')	35	1695

10" casing, 376'; 8¼" casing, 1620'; rock pressure in 4" pipe, 300 lbs.

J. A. Harbert No. 2142 Well Record (569).

Located in Eagle District, 1.5 miles northwest of Jimtown. Authority, Philadelphia Company. Completed May 18, 1907.

(Elevation, 1025' B-A.T.)	Thickness. Feet.	Total. Feet.
Unrecorded	160	160
Coal, Mapletown? (Redstone)	4	164
Unrecorded	21	185
Coal, Pittsburgh	7	192
Unrecorded	358	550
Sand, Little Dunkard? (Moundsville)	45	595
Unrecorded	117	712
Sand, Big Dunkard	50	762
Unrecorded	118	880
Sand, Salt? ("Gas")	73	953
Unrecorded	55	1008
Sand, Salt? (II Cow Run and Salt)	152	1260
Unrecorded	30	1290
Salt sand (coal, 1334'-1337'?)	54	1344

	Thickness. Feet.	Total. Feet.
Unrecorded	128	1472
Big Lime	67	1539
Big Injun sand (gas, 1555')	76	1615
Unrecorded	505	2120
Fifty-foot sand	30	2150
Unrecorded	62	2212
Thirty-foot sand (gas, 2216')	22	2234
Unrecorded	16	2250
Gordon Stray sand	23	2273
Unrecorded	10	2283
Gordon sand (gas, 2380')	117	2400
Unrecorded	15	2415
Fourth sand	35	2450
Unrecorded	125	2575
Fifth sand (gas, 2576')	3	2578

10" casing, 193'; 8¼" casing, 1280'; 6⅝" casing, 1518'; 4" casing, 2630'.

G. M. Martin No. 1 Well Record (571).

Located in Eagle District, 1 mile northwest of Jimtown. Authority, Carnegie Natural Gas Company. Completed Nov. 26, 1909.

(Elevation, 1065' B-A.T.)			Thickness. Feet.	Total. Feet.
Unrecorded			118	118
Pittsburgh coal			6	124
Unrecorded			1341	1465
Big Injun sand			110	1575
Unrecorded			365	1940
Sand, Fifty-foot? (Gantz)			55	1995
Unrecorded			60	2055
Sand, Thirty-foot			70	2125
Unrecorded			95	2220
Sand, Gordon Stray? (Gordon)			55	2275
Unrecorded			10	2285
Sand, Gordon? (gas, 2315', steel line)	40'	} (4th)	55	2340
Unrecorded	7			
Fourth sand	8			
Unrecorded			47	2387

B. F. Rogers No. 1788 Well Record (572).

Located in Eagle District, at Jimtown. Authority, Philadelphia Company.

(Elevation, 1005' B-A.T.)	Thickness. Feet.	Total. Feet.
Unrecorded (no coal)	275	275
Sand, Big Dunkard? (Moundsville)	40	315
Unrecorded	275	590
Sand, Salt (II Cow Run and Salt)	290	980
Unrecorded	325	1305
Big Injun sand (little gas, 1355')	100	1405
Unrecorded	645	2050

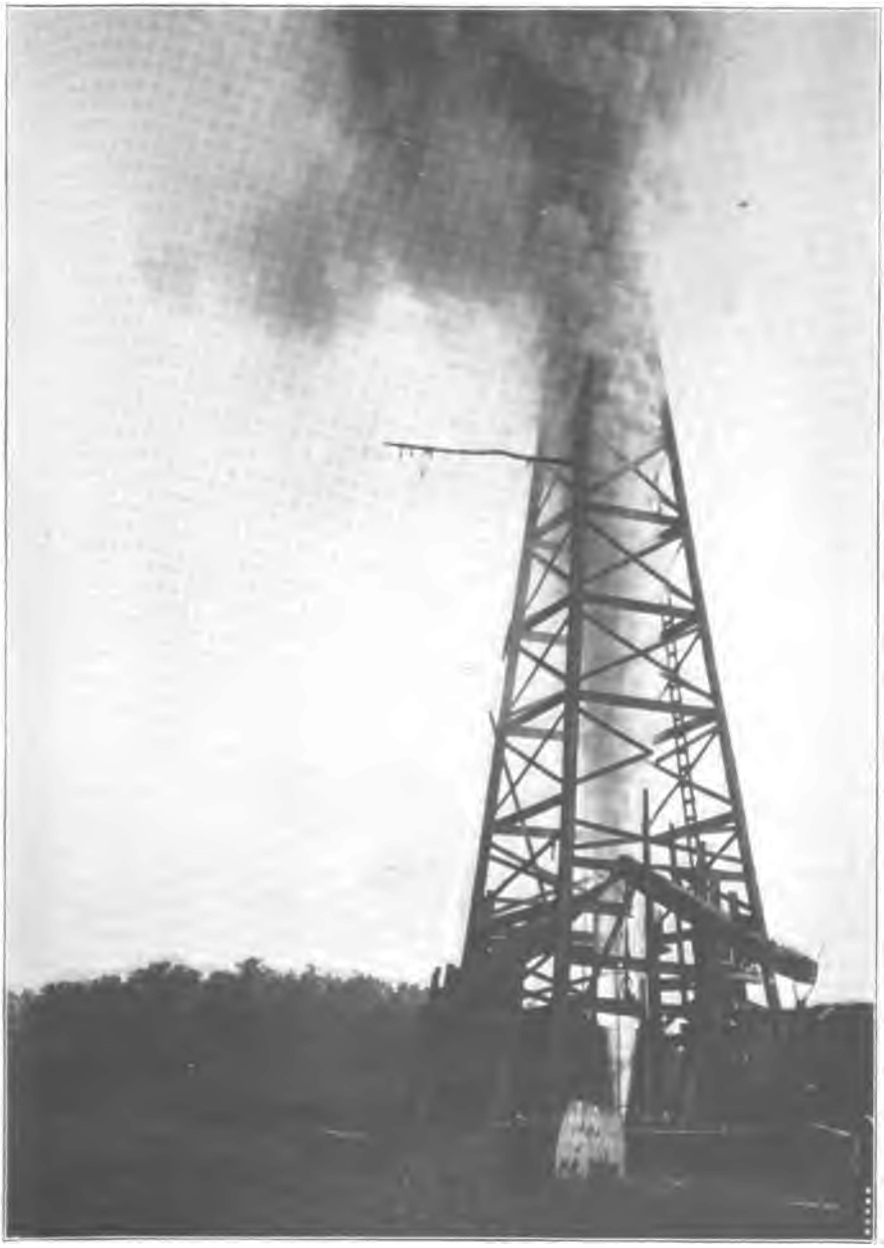


PLATE XVI.—Effect of Shot on the Paugh gas well (704) in Fifth sand, located two miles S. E. of Byron. Dry sand loosened by the Shot is being blown out with the gas.

	Thickness. Feet.	Total. Feet.
Gordon Stray sand	20	2070
Unrecorded	36	2106
Gordon sand (little gas, 2118')	24	2130

The well starts 50 to 60 feet below the Pittsburgh coal.

Ellis R. Fortney No. 1 Well Record (582).

Located in Eagle District, 1.5 miles northwest of Lumberport. Authority, Eagle District Gas Company. Completed August, 1910.

(Elevation, 975' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1170	1170
Big Lime	55	1225
Big Injun sand (gas, 1280')	100	1325
Unrecorded	425	1750
Fifty-foot sand	40	1790
Unrecorded	60	1850
Thirty-foot sand	30	1880
Unrecorded	145	2025
Sand, Gordon Stray? (Gordon) (gas, 2040')	35	2060
Unrecorded	10	2070
Sand, Gordon? (Fourth)	20	2090
Unrecorded	110	2200
Fifth sand (gas, 2207')	10	2210
Unrecorded to bottom	83	2293

10" casing, 220'; 6⅝" casing, 1225'; 3" tubing, 2295'.

The well starts about 175 feet below the Pittsburgh coal, and is reported as producing 1,400,000 cu. ft. daily. The gas at 2040 feet is in the Gordon, and not the Gordon Stray, since the former comes in this region 775 to 800 feet below the top of the Big Injun and about 280 feet below the top of the Fifty-foot sand. The boring is nearly on the crest of the Wolf Summit Arch.

Fletcher Robinson No. 1 Well Record (583).

Located in Eagle District, 1 mile southeast of Jimtown. Authority, Lumberport Gas Company. Completed Jan 8, 1910.

(Elevation, 985' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	230	230
Sand, Little Dunkard? (Moundsville)	40	270
Unrecorded	80	350
Big Dunkard sand	105	455
Unrecorded	55	510
Gas sand	50	560
Unrecorded	70	630
Sand, First Salt? (II Cow Run)	70	700

	Thickness. Feet.	Total. Feet.
Coal, (Tionesta)	10	710
Unrecorded	10	720
Second Salt sand	155	875
Unrecorded	65	940
Maxton sand	25	965
Unrecorded	125	1090
Little lime	35	1125
Pencil cave	25	1150
Big Lime	95	1245
Big Injun sand (gas 25/10 in water in 2″ pipe, 1320′)	75	1320
Unrecorded	15	1335
Sand, Squaw (Big Injun)	20	1355
Unrecorded	70	1425
Sand, Gantz? (Squaw)	35	1460
Unrecorded	80	1540
Berea sand	50	1590
Unrecorded	50	1640
Sand, Fifty-foot? (Gantz)	80	1720
Unrecorded	40	1760
Sand, Thirty-foot? (Fifty-foot) (gas, 1770′)	45	1805
Unrecorded	140	1945
Gordon Stray sand	30	1975
Unrecorded	20	1995
Gordon sand (gas, 2025′)	55	2050
Unrecorded	139	2189
Fifth sand (gas, 2190′)	29	2218
Unrecorded to bottom	99	2317

Unrecorded to bottom.................................. 99 2317

10″ casing, 168′; 8″ casing, 830′; 6⅝″ casing, 1213′; 3″ tubing, 2312′ set on bottom.

The well starts 140 to 150 feet below the Pittsburgh coal.

The waters of Little Tenmile, and Tenmile creeks drain the southwest border of Eagle district, and in this portion of the latter area there occur many fine gas wells in the Big Injun, Fifty-foot, Gordon, Fourth and Fifth sands. The six following records from this locality, scattered from Dola to Lumberport, give valuable data as to their pressure and volume, and the oil and gas horizons therein:

R. M. Rogers No. 2293 Well Record (575).

Located in Eagle District, 0.4 mile southeast of Dola. Authority, Philadelphia Company. Completed Sept. 4, 1909.

(Elevation, 1005′ B-A.T.)	Thickness. Feet.	Total. Feet.
Unrecorded (no coals)	460	460
Sand, Little Dunkard (Big Dunkard)	53	513
Unrecorded	127	640

	Thickness. Feet.	Total. Feet.
Gas sand	60	700
Unrecorded	20	720
Sand, Salt? (II Cow Run and Salt)	255	975
Unrecorded	305	1280
Big Lime	102	1382
Sand, Big Injun gas	100	1482
Unrecorded	493	1975
Thirty-foot sand	55	2030
Unrecorded	135	2165
Fourth sand	70	2235
Unrecorded	129	2364
Fifth sand (gas)	7	2371

10″ casing, 5224′; 8¼″ casing, 1019′; 6⅝″ casing, 1286′; 3″ tubing, 2369′.

"Pressure to the sq. inch in Big Injun and 5th sands:

Sep. 6, 1909, in 6⅝″:	Sep. 6, 1909, in 3″ tubing:
1st ½ minute, 10 lbs.	1st ½ minute, 30 lbs.
1st minute, 20 lbs.	1st minute, 50 lbs.
5th minute, 60 lbs.	5th minute, 130 lbs.
10th minute, 140 lbs.	10th minute, 220 lbs.
15th minute, 180 lbs.	60th minute, 625 lbs.
30th minute, 250 lbs.	Rock pressure, 780 lbs.
Rock pressure, 460 lbs.	

The well starts 85 feet, aneroid, below the Pittsburgh coal.

C. D. Robinson No. 2157 Well Record (578).

Located in Eagle District, 2 miles southwest of Lumberport. Authority, Philadelphia Company. Well completed April 17, 1907.

(Elevation, 1010′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	330	330
Sand, Little Dunkard (I Cow Run)	20	350
Unrecorded	15	365
Big Dunkard sand	130	495
Unrecorded	60	555
Sand, Salt? (Gas sand) (gas, 630′)	135	690
Unrecorded	20	710
Sand, Salt? (II Cow Run and Salt)	155	865
Unrecorded	360	1225
Big Lime	60	1285
Big Injun sand (gas, 1333′)	80	1365
Unrecorded	471	1836
Fifty-foot sand	61	1897
Unrecorded	185	2082
Gordon sand (gas, 2101′)	27	2109
Unrecorded	6	2115
Fourth sand and unrecorded	143	2258
Fifth sand (gas, 2260′)	12	2270
Unrecorded to bottom	58½	2328½

10" casing, 210'; 8¼" casing, 893'; 6⅝" casing, 1381'; 3" tubing, 2391'.

"Pressure to the sq. inch 6⅝" casing, Apr. 18, 1907:

1st ½ minute, 30 lbs. 10th minute, 280 lbs.
1st minute, 55 lbs. 15th minute, 375 lbs.
2nd minute, 80 lbs. 20th minute, 450 lbs.
5th minute, 170 lbs. Rock pressure, 810 lbs. in 15 hours

The well starts 125 feet, aneroid, below the Pittsburgh coal.

F. L. Robey No. 1 Well Record (579).

Located in Eagle District, 1.5 miles southwest of Lumberport. Authority, Carnegie Natural Gas Company. Completed May 3, 1910.

(Elevation, 985' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1304	1304
Big Injun sand	79	1383
Unrecorded	12	1395
Sand, Squaw? (Big Injun) (gas, 1400')	13	1408
Unrecorded	412	1820
Fifty-foot sand (gas, 1835')	43	1863
Unrecorded	212	2075
Gordon Stray sand	18	2093
Unrecorded	5	2098
Gordon sand	22	2120
Unrecorded	4	2124
Fourth sand (gas, 2148')	40	2164
Unrecorded	103	2267
Fifth sand (gas, 2270')	6	2273
Unrecorded to bottom	149	2422

"Open flow tests: 7/10 water in 6⅝" casing; 20/10 mercury in 2" tubing."

The well starts 100 feet, aneroid, below the Pittsburgh coal. The open flow tests give the total volume as 2,100,000 cubic feet daily.

E. L. Coffman No. 2362 Well Record (580).

Located in Eagle District, 1¼ miles southeast of Dola. Authority, Philadelphia Company. Completed June 6, 1910.

(Elevation, 1195' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	495	495
Big Dunkard sand	120	615
Unrecorded	215	830
Sand, Salt? (II Cow Run and Salt)	290	1120
Unrecorded	276	1396
Big Lime	71	1467
Big Injun sand (gas, 1517')	68	1535

	Thickness. Feet.	Total. Feet.
Unrecorded	10	1545
Sand, Squaw? (Big Injun)	15	1560
Unrecorded	365	1925
Fifty-foot sand	50	1975
Unrecorded	10	1985
Thirty-foot sand (gas, 1987′) and unrecorded	90	2075
Break	4	2079
Unrecorded (gas, 2087′ and 2090′) to bottom	26	2105

13″ casing, 16′; 10″ casing, 130′; 8¼″ casing, 1035′; 6⅝″ casing, 1396′; 4″ casing, 2116′.

Pressure to the sq. inch in 4″ tubing:

1st ½ minute, 175 lbs.
1st minute, 300 lbs.
2nd minute, 440 lbs.
5th minute, 700 lbs.
10th minute, 735 lbs.
15th minute, 740 lbs.
20th minute, 745 lbs.
Rock pressure, 710 lbs.

The well starts 40 to 50 feet above the Pittsburgh coal.

C. E. Boggess No. 4 Well Record (581).

Located in Eagle District 1¾ miles west of Lumberport. Authority, Carnegie Natural Gas Company.

(Elevation, 1075′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1315	1315
Big Injun sand (gas, 1320′)	85	1400
Unrecorded	455	1855
Fifty-foot sand	75	1930
Unrecorded	160	2090
Gordon Stray sand	20	2110
Unrecorded	10	2120
Gordon sand	40	2160
Unrecorded	50	2210
Fourth sand (gas, 2215′)	15	2225
Unrecorded	70	2295
Fifth sand (gas, 2298′)	5	2300
Unrecorded to bottom	32	2332

10″ casing, 160′; 8¼″ casing, 950′; 6⅝″ casing, 1290′; 3 tubing, 2332′.

"Pressure in 3″ pipe, 100 lbs."

The well starts 100′ aneroid, below the Pittsburgh Coal.

Horner Hardware Company No. 1 Well Record (587).

Located in Eagle District, at Lumberport. Authority, Lumberport Gas Company.

(Elevation, 920′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded (water at 30′ and 300′)	350	350
Sand, Little Dunkard (I Cow Run)	20	370
Unrecorded	30	400
Sand, Big Dunkard? (Big Dunkard and Burning Springs)	115	515
Gas sand	105	620

	Thickness. Feet.	Total. Feet.
Unrecorded	30	650
Sand, First Salt? (II Cow Run) (water, 665')	75	725
Unrecorded	15	740
Second Salt sand (water, 830')	145	885
Unrecorded	260	1145
Maxton sand	25	1170
Unrecorded	10	1180
Little lime	30	1210
Unrecorded	30	1240
Big Lime	70	1310
Big Injun sand	85	1395
Unrecorded	470	1865
Fifty-foot sand	40	1905
Unrecorded	15	1920
Thirty-foot sand	30	1950
Unrecorded	60	2010
Gordon Stray sand (steel line)	100	2110
Gordon sand (gas, 2118' and 2128'; 12-10 water in 5 3/16" casing)	25	2135
Unrecorded	133	2268
Fifth sand (gas, 2270', 2278', steel line)	22	2290

8¼" casing, 360'; 6⅝" casing, 945'; 5 3/16" casing, 2010'.

The well starts 10 feet below the Little Clarksburg coal, or 140 feet below the Pittsburgh horizon. The open flow test gives it a volume of 1,100,000 cu. ft. of gas daily from the Gordon. The Fifth sand volume is not noted.

The detailed log of the Caroline Mathews No. 1 well (588), located ¼ mile south of Lumberport, is given in connection with the section for the latter place, page 106, to which the reader is referred for volume data, etc.

The Ben. Mathews No. 1 well (589), located a short distance southeastward, was first a gasser in the Big Injun sand, and later drilled down to the Fourth, from which horizon it produces oil, according to information given D. B. Reger.

There occurs a small oil pool in the Fourth sand on Robinson run, 1 mile west of Shinnston. The pool was opened on the Ogden farm in March, 1910, the first well starting off at 250 barrels of oil daily. It was still producing 12.5 barrels daily on August 10, 1910. Its record is as follows:

V. B. Ogden No. 1 Well Record (592).

Located in Eagle District, 1½ miles southwest of Shinnston. Authority, South Penn Oil Company. Completed in March, 1910.

(Elevation, 935' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	280	280

	Thickness. Feet.	Total. Feet.
Sand, Dunkard? (I Cow Run)	155	435
Unrecorded	330	765
Sand, Salt? (II Cow Run and Salt)	200	965
Unrecorded	65	1030
Sand, Maxton? (Salt)	10	1040
Unrecorded	350	1390
Big Injun sand	90	1480
Unrecorded	375	1855
Fifty-foot sand (1880′)	45	1900
Unrecorded	15	1915
Thirty-foot sand	75	1990
Unrecorded	225	2215
Fourth sand (oil, 2219′ and 2247′)	43	2258
Unrecorded to bottom	7	2265

The well starts about 30 feet below the Pittsburgh coal.

V. B. Ogden No. 2 Well Record (593).

Located in Eagle District, 1½ miles S. 80° W. of Shinnston. Authority, South Penn Oil Company.

(Elevation, 965′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	400	400
Sand, Little Dunkard? (Moundsville)	8	408
Unrecorded	17	425
Sand, Big Dunkard? (Big Dunkard and Burning Springs)	200	625
Unrecorded	65	690
Gas sand	60	750
Unrecorded	10	760
Sand, "Gas"? (II Cow Run)	70	830
Unrecorded	30	860
Salt sand	150	1010
Unrecorded	10	1020
Salt sand	40	1060
Unrecorded	277	1337
Big Lime	68	1405
Big Injun sand	100	1505
Unrecorded	345	1850
Gantz sand	30	1880
Unrecorded	30	1910
Fifty-foot sand (gas, 1940′)	35	1945
Unrecorded	10	1955
Thirty-foot sand }	55	2010
Unrecorded } (30-ft.)	3	2013
Sand, Stray }	42	2055
Unrecorded	25	2080
Sand, Gordon? (Gordon Stray)	25	2105
Unrecorded	55	2160
Gordon sand	25	2185
Unrecorded	5	2190
Fourth sand (oil, 2229′-2237′)	62	2252
Unrecorded to bottom	13	2265

Initial oil production, 25 barrels daily.

The well starts 15 feet below the Pittsburgh coal.

Three-fourths mile southward, within the peninsula formed by West Fork river, the Haywood Oil & Gas Company recently drilled in a hundred barrel well in the Fourth sand on the J. H. Towles farm (591).

Four miles southwestward, there occurs a pool of 12 to 15 oil wells near the head of Lamberts run in what appears to be the Fourth sand and not the Gordon as given by the original log. The following record of one of these wells shows the horizon at which the oil is encountered.

Howard Gore No. 1 Well Record (597).

Located in Eagle District, 1.5 miles southwest of Hepzibah. Authority, G. M. Allender.

(Elevation, 1265′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	208	208
Coal, Pittsburgh	6	214
Unrecorded	399	613
Sand, Little Dunkard (I Cow Run)	42	655
Unrecorded	50	705
Big Dunkard sand	55	760
Unrecorded	213	973
Sand, "Gas"? (II Cow Run)	39	1012
Unrecorded	11	1023
Salt sand	207	1230
Unrecorded	320	1550
Little lime	14	1564
Unrecorded	6	1570
Big Lime	51	1621
Big Injun sand (gas, 1683′)	109	1730
Unrecorded	400	2130
Fifty-foot sand	50	2180
Unrecorded	10	2190
Thirty-foot sand	70	2260
Unrecorded	115	2375
Sand, Gordon Stray? (Gordon)	12	2387
Unrecorded	5	2392
Sand, Gordon? (Fourth) (oil, 2466′) to bottom	76	2478

10″ casing, 222′; 6⅝″ casing, 1612′.

In the writer's judgment, the oil horizon is the same here as that in the Ogden pool, 1 mile west of Shinnston, where the top of the oil pay comes 2244 feet below the Pittsburgh coal. The last record above given shows the oil pay 2242 feet below the same coal. The log of a gas well (657), located on the Hamrick farm, 1.2 miles southwest from the Lambert run oil pool, and used in connection with the Wolf Summit

N. E. section, shows the same oil pay 2221 feet below the same coal.

Prospective Oil and Gas Territory, Eagle District.—The development in Eagle district has been quite rapid in recent years, but, as in other portions of Harrison, already discussed, there remains a large acreage that is favored both by present development and geologic structure to warrant further drilling for oil and gas. These areas will be considered from northwest to southeast across the district. (1) That territory just east of Margaret, along the line joining the Serena Wyer No. 1 well (535) and the I. Moore (O. Hawker) No. 1 (537) in the edge of Marion county, appears favorable for Thirty-foot sand oil; (2) that, in the same region along the line joining the Loretta Morris No. 1 well (536), and the Sarah Baker No. 1 well (539), seems good for Gordon Stray sand oil; (3) that, immediately on the east of the last mentioned territory extending with a width of ½ to 1 mile northeastward from the channel of Jones creek to the Harrison-Marion county line, appears good for gas in both the Big Injun and Gordon; (4) that, southward from Jones creek at Jimtown to a line joining Dola with the H. N. Hustead No. 1 well (576), appears favorable for gas in the Big Injun, Gordon and Fifth sands; (5) that, northeastward from Jimtown as drained by the waters of Nolan run, for gas at the same horizon; and (6) that, southwestward from the headwaters of Wolfpen run, 0.8 mile west of Gypsy, to the Lambert run oil pool, for Fourth sand oil, and gas in the Big Injun, Fifty-foot and Fifth sands.

CLAY DISTRICT.

Clay district occupies the northeastern corner of Harrison county, and its area is traversed in an almost north and south direction by the axis of the Shinnston syncline. By far the greater portion of the district, however, lies on the east side of the axis of the latter fold. A glance at the structure map accompanying this report will show that much relief prevails therein, the Pittsburgh coal varying from about 865′ A.T. at the mouth of Little Bingamon, to 1435′ A.T., 2 miles southeast of McAlpin. In the region of Adamsville, it will be observed there occurs a pronounced structural terrace, as exhibited by the wide divergence of the 1050 and 1150-foot contours of the Pittsburgh coal from their position to the northeast at their intersection with Booths creek. A great oil pool has been developed in the Fifty-foot sand along this terrace in Clay district, the same being frequently referred to as the **Shinnston oil pool.** It is just such a terrace as this on which rest the Smithfield oil pool of Wetzel county, and the Elk Fork oil pool of Tyler county. All efforts to extend this Fifty-foot sand oil pool to the northeast of the Harrison-Marion county line, and southwest to Shinns run, where the structural slope is much steeper, have thus far proved fruitless.

The northwest corner of Clay reaches almost to the crest of the Wolf Summit anticline; hence, in this portion of the district, there occur several (20 to 25) fine gas wells. The four following records from wells in this region give interesting data as to the rock pressure and the oil and gas horizons:

Geo. Millan No. 1 Well Record (603).

Located in Clay District, ¼ mile southeast of Pine Bluff. Authority, Carnegie Natural Gas Company. Completed May 13, 1910.

(Elevation, 1297' L-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	394	394
Coal, Pittsburgh	6	400
Unrecorded	1414	1814
Big Injun sand	106	1920
Unrecorded	395	2315
Fifty-foot sand	85	2400
Unrecorded	200	2600
Sand, Gordon Stray? (Gordon)	20	2620
Gordon sand	18	2638
Unrecorded	72	2710
Fourth sand	16	2726
Unrecorded	50	2776
Fifth sand (gas)	18	2794
Unrecorded to bottom	38	2832

10" casing, 470'; 8¼" casing, 1350'; 6⅝" casing, 1786'.

Pressure to the sq. inch in 6⅝" casing:

2nd minute, 15 lbs.
3rd minute, 20 lbs.
4th minute, 25 lbs.
5th minute, 30 lbs.
10th minute, 60 lbs.
18th minute, 100 lbs.

Seymour Stark No. 1 Well Record (604).

Located in Clay District, 1.8 miles northwest of Shinnston. Authority, Fairmont and Grafton Gas Company.

(Elevation, 1115′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	107	107
Pittsburgh coal	11	118
Unrecorded	392	510
Sand, Little Dunkard? (Moundsville)	25	535
Unrecorded	105	640
Big Dunkard sand	40	680
Unrecorded	220	900
Sand, "Gas"? (II Cow Run)	80	980
Unrecorded	95	1075
Salt sand	95	1170
Unrecorded	35	1205
Sand, Maxton? (Salt)	65	1270
Unrecorded	165	1435
Big Lime	75	1510
Big Injun sand	60	1570
Unrecorded	390	1960
Sand, Fifty-foot (Gantz and 50-ft.) (gas, 2040′; volume, 200,000 cu. ft. daily)	95	2055
Unrecorded	195	2245
Gordon sand	20	2265
Unrecorded	135	2400
Sand, Fourth? (Fifth) (gas, 2402′; rock pressure, 1180 pounds; volume, 350,000 cu. ft.)	10	2410
Unrecorded	75	2485
Sand, Fifth? (Sixth), shell and unrecorded to bottom	76	2561

This well was drilled several years ago and was among the first in the field as is self-evident from the great rock pressure (1180 pounds to the square inch) recorded in the Fifth sand.

Lucas Bros. No. 1 Well Record (604A).

Located in Clay District, 1 mile west of Shinnston. Authority, Fairmont and Grafton Gas Company.

(Elevation, 935′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	400	400
Sand, Little Dunkard? (Moundsville)	25	425
Unrecorded	115	530
Big Dunkard sand	35	565
Unrecorded	230	795
Sand, "Gas" (II Cow Run)	55	850
Unrecorded	120	970
Salt sand	95	1065
Unrecorded	35	1100
Maxton sand	65	1165
Unrecorded	153	1318

	Thickness. Feet.	Total. Feet.
Big Lime	103	1421
Big Injun sand (gas, 1425'; rock pressure, 700 lbs.; volume, 4,000,000 cu. ft. daily through 4" tubing)	50	1471

The well starts at the top of Pittsburgh coal. An analysis of the gas from this well, along with others in the vicinity, is given on page 556 of Volume I(A), as follows:

Analyses of Natural Gas.

Made during June, 1904, by C. D. Howard. (Percentage by vol.)

	Sample No. 1	Sample No. 2	Sample No. 3	Sample No. 4	Sample No. 5	Sample No. 6
Carbon dioxide (CO_2)	0.006	0.1	0.0	0.0	0.1	0.0
Carbon monoxide (CO)	0.4	0.4	0.4	0.4	0.4	0.5
Oxygen (O)	0.2	0.2	0.2	0.1	0.3	0.3
Hydrogen (H)	trace	0.2	0.0	0.1	0.1	0.0
Heavy hydrocarbons	0.4	0.2	0.4	0.2	0.1	0.2
Ethane (C_2H_4)	14.60	14.09	15.09	14.88	14.35	7.65
Methane (CH_4)	80.94	81.60	75.95	80.85	80.70	86.48
Nitrogen (N)	3.46	3.21	3.96	3.47	3.95	4.87
Ammonia (NH_3)	none	none	none	none	none	none
Carbon bisulphide (CS_2)	none	none	none	none	none	none
Sulphuretted hydrogen (H_2S)	none	none	none	none	none	none
Moisture (grains in 100 cu. ft.)	17.72	....	....	....	....	....
Total Sulphur (gr. in 100 cu. ft.)	0.182	....	....	....	....	....
Total paraffines	95.54	95.69	95.04	95.73	95.05	94.13
*B. T. U. per cu. ft. (calculated)	1142.6	1136.9	1140.9	1143.6	1131.4	1065.3

"Sample No. 1—Morgantown supply (Big Injun sand), Monongalia and Greene (Penna.) counties.

"Sample No. 2—Fairmont supply (Bayard sand), Marion county.

"Sample No. 3—Big Injun sand gas from Lucas Brothers well No. 1, 1¼ miles northwest of Shinnston. Top of sand, 1421 feet below Pittsburgh coal.

"Sample No. 4—Gordon sand gas (Shinnston supply) from J. B. Cunningham well No. 1, 3½ miles northwest of Shinnston, Harrison county. Top of sand, 2199 feet below Pittsburgh coal.

"Sample No. 5—Fifth sand gas from Harbert well No. 1, near West Fork river, and three-fourths mile due east of Lumberport, Harrison county. Top of sand, 2380 feet below the Pittsburgh coal.

"Sample No. 6—"Fifty-foot" sand gas from Lucas Brothers well No. 4, 1 mile west of Shinnston, near the mouth of Robinson run, Harrison county. Top of sand, 1855 feet below the Pittsburgh coal."

---

*Prof. Jones reports B. T. U. slightly over 1100 by Junker calorimeter. Natural gas is taken as a standard (1000) assuming 94 per cent.

Samples Nos. 3, 4, 5 and 6 are from wells Nos. 604A, 563, 648A, and 605A respectively, as listed in the table of wells for Harrison county, page 408. The two following records are from two of these wells:

Lucas Bros. No. 4 Well Record (605A).

Located in Clay District, 1 mile west of Shinnston. Authority, Fairmont and Grafton Gas Company.

Elevation, 900′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	370	370
Sand, Little Dunkard (I Cow Run)	40	410
Unrecorded	90	500
Sand, Big Dunkard (Burning Springs)	75	575
Unrecorded	165	740
Sand, "Gas" (II Cow Run) and unrecorded	200	940
Salt sand	130	1070
Unrecorded	190	1260
Maxton sand	25	1285
Unrecorded	47	1332
Big Lime	60	1392
Big Injun sand (gas, 1397′) and unrecorded	443	1835
Fifty-foot sand (gas, 1861′; 200,000 cu. ft. daily) and unrecorded	65	1900
Thirty-foot sand and unrecorded	100	2000
Stray sand and unrecorded	120	2120
Gordon sand and unrecorded	196	2216
Sand, (Fourth) (½ bbl. dark oil.)		

Well starts about 45 feet below Pittsburgh coal.

Luther Harbert No. 1 Well Record (648A).

Located in Clay District, 0.7 mile northwest of Gypsy. Authority, Fairmont and Grafton Gas Company.

(Elevation, 900′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	545	545
Big Dunkard sand	25	570
Unrecorded	162	732
Gas sand	73	805
Unrecorded	65	870
Salt sand	105	975
Unrecorded	309	1284
Big Lime	73	1357
Big Injun sand (gas, 1382′; rock pressure, 650 lbs.; volume, 1,500,000 cu. ft. daily)	75	1432
Unrecorded	386	1818
Gantz sand	34	1852
Unrecorded	28	1880
Fifty-foot sand	25	1905

	Thickness. Feet.	Total. Feet.
Unrecorded	83	1988
Sand, Stray? (30-ft.)	26	2014
Red rock	40	2054
Red sand, (Stray)	50	2104
Gordon sand	25	2129
Red rock	31	2160
Fourth sand	40	2200
Unrecorded	135	2335
Fifth sand (gas, 2340′; rock pressure, 1100 lbs.; volume, 2,000,000′ in 5$\frac{3}{16}$″ casing)	18	2353

The well starts about 45 feet below the Pittsburgh coal.

The three foregoing records are very interesting in that they give the original rock pressure of Big Injun and Fifth sands in the first wells drilled in the field.

The two following records in Clay district are from wells located on the east side of West Fork river, near the Harrison-Marion county line:

John F. Sturms Heirs No. 1 Well Record (609).

Located in Clay District, ¾ mile east of Enterprise. Authority, Carnegie Natural Gas Company. Completed October 10, 1910.

(Elevation, 1055′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	82	82
Coal, Pittsburgh	7	89
Unrecorded	1417	1506
Big Injun sand (gas, 1528′) to bottom	39	1545

10″ casing, 95′; 8¼″ casing, 1100′; 6⅝″ casing, 1506′; 4″ tubing, 1545′.

Pressure to the sq. inch in 4″ tubing from Big Injun sand:

1st ½ minute, 145 lbs.	4th minute, 400 lbs.
1st minute, 235 lbs.	5th minute, 405 lbs.
2nd minute, 340 lbs.	20th minute, 435 lbs.
3rd minute, 375 lbs.	Rock pressure, 500 lbs.

Alice Corpening No. 1 Well Record (612).

Located in Clay District, 1.7 miles S. 75° E. of Enterprise. Authority, South Penn Oil Company.

(Elevation, 995′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1439	1439
Big Injun sand	104	1543
Unrecorded	507	2050
Gordon sand	10	2060
Unrecorded	110	2170
Sand, Fifth? (Fourth)	30	2200
Unrecorded (gas in Bayard sand)	306	2506

The well mouth is 30 feet, aneroid, below the Pittsburgh coal.

The sand at 2170 feet is evidently the same horizon as that in which the oil pool occurs, one mile west of Shinnston. The gas encountered was probably in the Fifth sand.

Shinnston Oil Pool.—As mentioned on a preceding page, what is known as the Shinnston oil pool, rests on a structural terrace or bench on the western slope of the Chestnut Ridge anticline, and contains about 150 oil wells in the Fifty-foot sand. The pool is really separated into two distinct fields by a barren zone in the Fifty-foot that follows closely the line of the dry holes, Nos. 637 and 622, located near the head of Sweep and Jarvis runs, respectively. The first field is located on the waters of Laurel run, and Coons run in the immediate vicinity and northwest of Adamsville; the second field is located slightly higher up the structural slope on the waters of Jarvis and Horner runs, extending to the southwest on the head of Coons run, containing 60 to 75 oil wells. In the latter field the oil pay appears to shift deeper in the sand as the structural slope is ascended to the southeast.

The following is a record of the first oil well obtained in the Shinnston oil pool. The well was drilled in December, 1908, primarily for gas, and is located on a branch of Mudlick run:

R. R. Hardesty No. 1 Well Record (614).

Located in Clay District, 2 miles due east of Shinnston. Authority, G. M. Allender. Completed in December, 1908.

(Elevation, 1170′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	148	148
Pittsburgh coal	9	157
Unrecorded	393	550
Sand, Little Dunkard? (Moundsville)	15	565
Unrecorded	115	680
Big Dunkard sand	60	740
Unrecorded	35	775
Gas sand	25	800
Unrecorded	10	810
Sand, Salt? ("Gas" and II Cow Run) (water, 920′)	205	1015
Break	15	1030
Salt sand	190	1220
Unrecorded	305	1525
Little lime	29	1554

	Thickness. Feet.	Total. Feet.
Pencil cave	6	1560
Big Lime	67	1627
Big Injun sand	110	1737
Unrecorded	78	1815
Squaw sand	15	1830
Unrecorded	70	1900
Berea sand	10	1910
Unrecorded	190	2100
Fifty-foot sand (oil) to bottom and still in sand	35	2135

10" casing, 168'; 6⅝" casing, 1660'.

No data was obtained as to the original production of this well.

The following record is from a well in this field that probably had the greatest initial oil production of any other well ever drilled in the State. It started off at 10,800 barrels daily, and created intense excitement and activity in drilling operations:

E. E. Swiger No. 2316 Well Record (618).

Located in Clay District, ½ mile northwest of Adamsville. Authority, Philadelphia Company. Completed December 6, 1909.

	Thickness. Feet.	Total. Feet.
Unrecorded	60	60
Pittsburgh coal	7	67
Unrecorded	469	536
Big Dunkard sand	104	640
Unrecorded	160	800
Gas sand (water, 830')	20	820
Unrecorded	63	883
Sand, Salt? (II Cow Run)	17	900
Unrecorded	15	915
Salt sand	7	922
Unrecorded	100	1022
Salt sand	15	1037
Unrecorded	441	1478
Big Lime	67	1545
Big Injun sand	153	1698
Unrecorded	343	2041
Sand, Fifty-foot (gas, 2041'; oil, 2042', 2058', 2063', 2077', 2087', 2112'; gas, 2112')	72	2113

10" casing, 98'; 8¼" casing, 696'; 6⅝" casing, 1478'; 5$\frac{3}{16}$" casing, 1618'; 3" tubing, 2120'; 2" tubing, 2113'.

"Well made 450 bbls. per hour when drilled in at 2081'."

"Drilled to 2113 feet January 27, 1910. Shot with 20 quarts, February 11, 1910."

The Fifty-foot sand in this region comes about 500 feet below the top of the Big Injun sand.

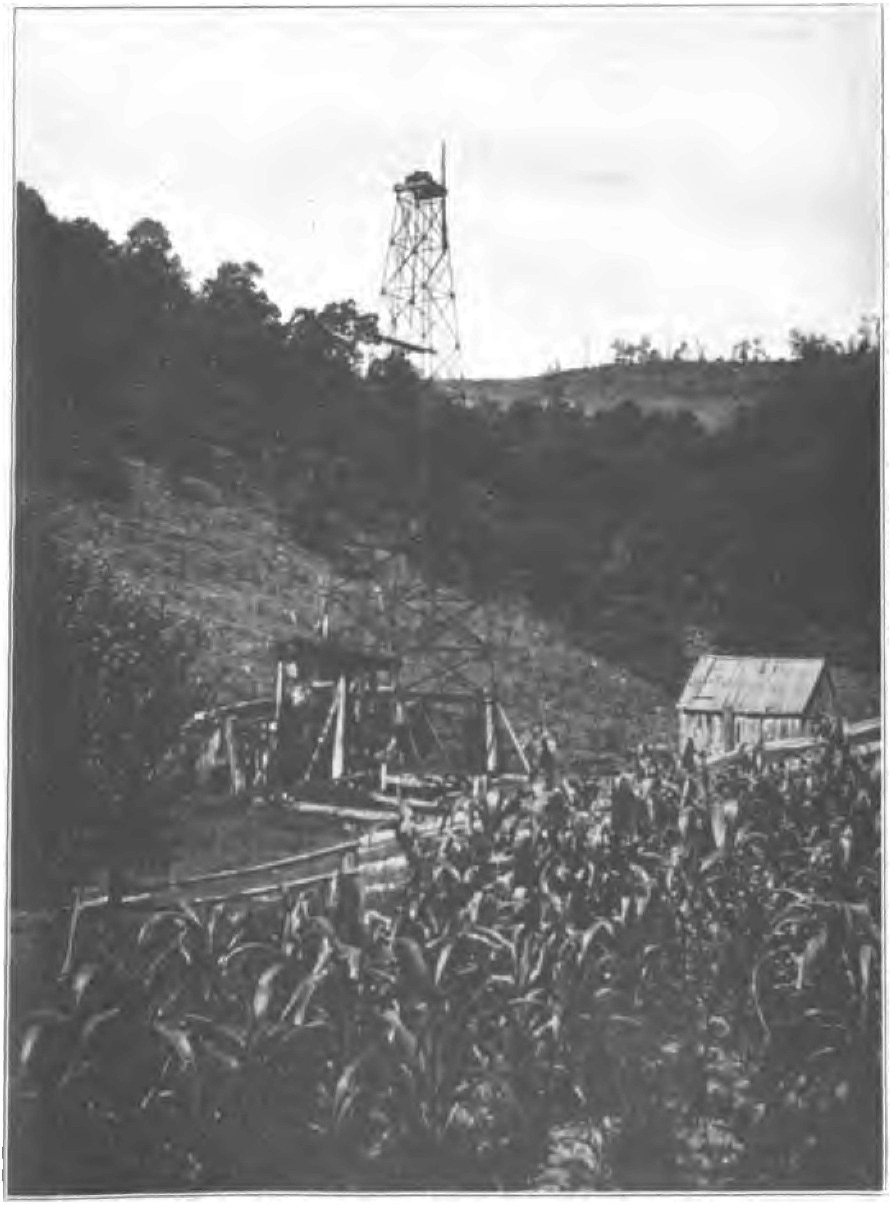


PLATE XVII.—Steel-tube Derrick used by the South Penn Oil Co.—
McIntyre well (356), 2½ miles south from Rinehart
—and Dunkard series Topography.

The following is a record of a well 300 or 400 feet south of the Swiger well, that was drilled in during January, 1910. This well started off at 2700 barrels of oil daily from the Fifty-foot sand, and at the end of eight months was still producing 180 barrels daily, according to an official of the South Penn Oil Company who also reports it at this time to have made twice as much oil as the Swiger well. The Whiteman well made 98,000 barrels the first 30 days after completion:

E. J. Whiteman No. 2 Well Record (619).

Located in Clay District, 1½ miles N. 10° W. of Adamsville. Authority, South Penn Oil Company. Completed in January, 1910.

(Elevation, 1090′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	440	440
Sand, Little Dunkard (I Cow Run)	35	475
Unrecorded	95	570
Sand, Big Dunkard	25	595
Unrecorded	5	600
Sand, "Gas"? (Burning Springs)	60	660
Unrecorded	10	670
Gas sand, (water, 700′)	150	820
Unrecorded	10	830
Sand, Salt? (II Cow Run)	50	880
Unrecorded	5	885
Salt sand, (water, 930′)	185	1070
Unrecorded	340	1410
Big Lime	100	1510
Big Injun sand	120	1630
Unrecorded	362	1992
Fifty-foot sand (gas, 1997′; oil, 1999′ and 2020′) to bottom	28	2020

The well starts about 30 feet above the Pittsburgh coal.

The following record is from a well in the first mentioned field of the Shinnston pool.

S. L. Vincent No. 5 Well Record (621).

Located in Clay District, ¼ mile south of Adamsville.

(Elevation, 1085′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	430	430
Sand, Little Dunkard (I Cow Run)	15	445
Unrecorded	75	520
Big Dunkard sand	50	570
Unrecorded	150	720

	Thickness. Feet.	Total. Feet.
Gas sand	60	780
Unrecorded	40	820
Sand, "Gas"? (II Cow Run)	80	900
Unrecorded	35	935
Salt sand	85	1020
Unrecorded	411	1431
Big Lime	74	1505
Big Injun sand	115	1620
Unrecorded	375	1995
Fifty-foot sand (oil, 2012′ and 2017′)	67	2062
Unrecorded to bottom	2	2064

The well starts almost flush with the Pittsburgh coal.

Near the northwestern edge of this field, on Laurel run, the G. L. Hardesty No. 7 well (610) started off in March, 1910, at the rate of 35 barrels of oil an hour, equivalent to 840 barrels daily. At the southwest edge of this field, on a branch of Mudlick, the E. M. Sapp No. 1 well (615) had an initial production, May 9, 1909, of 10 barrels of oil from the Fifty-foot daily, and was still making on Aug. 15, 1910, 10 barrels weekly.

The following is a record of a dry hole in the barren belt of the Fifty-foot sand, that separates the two fields of the Shinnston pool. The well starts about 320 feet above the Pittsburgh coal:

A. W. Hartley Heirs No. 1 Well Record (622).

Located in Clay District, ½ mile east of Adamsville. Authority, South Penn Oil Company.

(Elevation, 1390′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1825	1825
Big Injun sand	150	1975
Unrecorded	525	2500
Gordon sand	20	2520
Unrecorded	140	2660
Fifth sand	20	2680
Unrecorded to bottom	148	2828

The five following records are from wells located in the second division above mentioned of the Shinnston pool:

A. W. Hartley Heirs No. 3 Well Record (623).

Located in Clay District, ¾ mile southeast of Adamsville. Authority, Chas. B. Jackson, a driller. Completed Oct. 12, 1910.

(Elevation, 1515' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded (water, 150')	440	440
Pittsburgh coal	6	446
Unrecorded	394	840
Sand, Little Dunkard (I Cow Run)	50	890
Unrecorded	110	1000
Big Dunkard sand	35	1035
Unrecorded	130	1165
Gas sand	45	1210
Unrecorded	5	1215
Sand, Salt? (II Cow Run and Salt) (water, 1280' and 1420')	285	1500
Unrecorded	15	1515
Red rock	210	1725
Unrecorded	120	1845
Little lime	10	1855
Pencil cave, slate	5	1860
Big Lime	50	1910
Big Injun sand (gas, 1920')	100	2010
Unrecorded	5	2015
Sand, (Squaw)	85	2100
Slate	338	2438
Fifty-foot sand (oil, 2480')	96	2534
Unrecorded to bottom	5	2539

10" casing, 500'; 8¼" casing, 1400'; 6⅝" casing, 1920'.

The well starts nearly on the summit of a high knob.

E. W. Thompson No. 1 Well Record (624).

Located in Clay District, 1 mile S. 15° E. of Adamsville. Authority, Fred L. Bishop, Morgantown, W. Va. Completed in 1910.

	Thickness. Feet.	Total. Feet.
Unrecorded	170	170
Coal, Pittsburgh	10	180
Unrecorded	420	600
Sand, Little Dunkard (I Cow Run)	25	625
Unrecorded	50	675
Big Dunkard sand	50	725
Unrecorded	175	900
Sand, "Gas" (Clarion)	50	950
Unrecorded	10	960
Sand, Salt? (II Cow Run and Salt)	360	1320
Unrecorded	265	1585
Pencil cave	7	1592
Big Lime	80	1672
Big Injun sand (gas pay, 1685'-1700' and 1752'-1757')	180	1852
Unrecorded	320	2172
Fifty-foot sand (oil pay, 2208'-2215')	86	2258

10" casing, 270'; 8¼" casing, 1126'6"; 6⅝" casing, 1592'3".

The detailed log of the W. M. Gray No. 1 well (625), located 0.4 miles southwestward from the Thompson boring, is published in connection with the Adamsville section, page 107. It had an initial production of 10 barrels of oil and 3,000,000 cubic feet of gas daily. Mr. W. A. Chambers of Bridgeport, Harrison county, saved samples for analysis of the Upper Kittanning coal, and one of the Pottsville beds from this well, the results of which are found at the end of the table of coal analyses in a subsequent chapter of this report.

Dora Bartlett No. 1 Well Record (628).

Located in Clay District, 1.1 miles southeast of Adamsville. Authority, South Penn Oil Company. Completed Oct. 1, 1909.

	Thickness. Feet.	Total. Feet.
Unrecorded	135	135
Pittsburgh coal and unrecorded	1986	2121
Fifty-foot sand (first pay, light, 2190'; second pay, good, 2203')		

This well was one of the best in this portion of the Shinnston pool, having started off at 550 barrels of oil daily, and was still making on August 16, 1910, 90 barrels a day, according to an official of the operating company.

Nimshi Nuzum No. 4 Well Record (630).

Located in Clay District, ¾ mile west of Boothsville. Authority, Geo. E. Miller & Company. Completed June 25, 1910.

(Elevation, 1165' B-A. T.)	Thickness. Feet.	Total. Feet.
Conductor	16	16
Unrecorded	24	40
Pittsburgh coal	10	50
Unrecorded (water, 160')	220	270
Sand, "Gas"? (Murphy)	20	290
Unrecorded	68	358
Coal, (Harlem)	8	366
Unrecorded	124	490
Sand, Little Dunkard (I Cow Run)	30	520
Unrecorded	78	598
Big Dunkard sand	42	640
Unrecorded	10	650
Sand, (Burning Springs)	40	690
Unrecorded	36	726
Coal, (Upper Kittanning)	4	730
Unrecorded	63	793

	Thickness. Feet.	Total. Feet.
Coal, (Lower Kittanning)	6	799
Unrecorded	4	803
Sand, First Salt? (II Cow Run)	33	836
Unrecorded	124	960
Salt sand	70	1030
Unrecorded	332	1362
Sand	19	1381
Unrecorded	67	1448
Little lime	10	1458
Pencil cave	8	1466
Big Lime	88	1554
Big Injun sand (light gas, 1645′)	106	1660
Unrecorded	110	1770
Sand, Gantz? (Squaw)	22	1792
Unrecorded	258	2050
Fifty-foot sand (light gas, 2057′; heavy gas, 2066′-2075′; began spraying oil, 2075′; second pay of green oil, 2091′) and unrecorded to bottom	92	2142

Initial oil production, 750 barrels daily.”

The above record is very interesting, in that four well-known coals are noted; viz., Pittsburgh, Harlem, Upper Kittanning, and Lower Kittanning. The Pittsburgh-Harlem coal interval in this portion of Harrison county is shown to be 308 feet. In the southeastern part of the same area, it is 320 to 330 feet.

Nimshi Nuzum No. 1 Well Record (631).

Located in Clay District, 0.8 mile west of Boothsville. Authority, Geo. E. Miller & Company. Completed December 17, 1909.

	Thickness. Feet.	Total. Feet.
Surface	16	16
Unrecorded	44	60
Pittsburgh coal		
Unrecorded	30	90
Sand, Murphy? (Lower Pittsburgh)	30	120
Unrecorded	389	509
Sand, Big Dunkard? (I Cow Run)	51	560
Unrecorded	58	618
Sand, “Gas”? (water at 648′) (Big Dunkard)	43	661
Unrecorded	6	667
Sand, First Salt? (“Gas”)	131	798
Unrecorded	12	810
Sand, Second Salt (II Cow Run and Salt) (water at 1022′)	253	1063
Red rock and shells	89	1152
Unrecorded	292	1444
Little lime	12	1456

	Thickness. Feet.	Feet. Feet.
Pencil cave	14	1470
Big Lime	83	1553
Big Injun sand (no oil or gas)	105	1658
Unrecorded	139	1797
Sand, Gantz? (Squaw)	12	1809
Unrecorded	254	2063
Top of Fifty-foot sand		2063
Gas at		2069
Gas increased to		2083
Began spraying oil		2083
Oil increased from 2083′ to		2093
Unrecorded	10	2103
Second pay—green oil, 2103′ to		2110
Unrecorded	12	2122
Third pay, 2122′ to		2130
Total depth of well		2164

10″ casing, 170′; 8¼″ casing, 1095′; 6⅝″ casing, 1495′.

"Initial oil production, 250 barrels daily, and making 75 barrels at end of first month."

"Thickness of Pittsburgh coal not given, but an opening near the well shows about the usual thickness."

The following is the record of a gasser in the Fifty-foot, located 0.3 mile due west of the common corner to Harrison, Marion and Taylor counties. The well starts about 45 feet below the Pittsburgh coal; hence, the coals at 70 feet and 285 feet correlate with the Little Clarksburg and Harlem, respectively:

Jos. Ashcraft No. 1 Well Record (632).

Located in Clay District, ¼ mile west of Boothsville. Authority, Philadelphia Company. Completed January 10, 1910.

(Elevation, 1115′ B-A. T.)	Thickness. Feet.	Total. Feet.
Shale (?)	70	70
Coal, (Little Clarksburg) (water) at	0	70
Red rock	10	80
Shale	80	160
Red rock	15	175
Shale	10	185
Lime	5	190
Shale	40	230
Sand	30	260
Lime (Ames)	25	285
Coal, (Harlem)	0	285
Shale	35	320
Lime	10	330
Shale	30	360
Sand, (Moundsville)	10	370
Shale	30	400
Slate	100	500

	Thickness. Feet.	Total Feet.
Sand (Big Dunkard)	15	515
Lime	30	545
Sand, (Burning Springs)	25	570
Shale	60	630
Lime	10	640
Coal, (Upper Kittanning)	0	640
Lime	35	675
Slate	50	725
Sand, Salt? (II Cow Run and Salt)	125	850
Slate	30	880
Sand, (Salt)	70	950
Slate	30	980
Sand, (Salt)	65	1045
Slate	15	1060
Sand	35	1095
Shale	25	1120
Sand (Maxton)	20	1140
Red rock	5	1145
Lime	10	1155
Unrecorded	195	1350
Red rock	20	1370
Little lime	30	1400
Shale	15	1415
Big Lime	95	1510
Big Injun sand	170	1680
Shale	15	1695
Squaw sand, brown	15	1710
Shale	80	1790
Stray sand	15	1805
Shale	145	1950
Lime	5	1955
Fifty-foot sand, broken (gas)	110	2065
Shale	5	2070
Lime	20	2090
Shale	15	2105
Red rock	20	2125
Gordon Stray sand	20	2145
Slate	5	2150
Gordon sand to bottom	25	2175

The log of the R. L. Reed No. 1 Well (633), located ¼ mile due southward, is published in connection with the Boothsville section, page 109. A light show of gas was encountered in the Big Injun, and a small oil show in the Fifty-foot sand in this well.

Southwestward a light gasser was drilled on the south hill-side of Horner run on the J. R. Bartlett farm (627). The following record is from a gas well located in the southeastern part of Clay district, along the steep western slope of the Chestnut Ridge anticline:

Martha Chalfant No. 1 Well Record (640).

Located in Clay District, 1 mile northeast of McAlpin. Authority, South Penn Oil Company.

(Elevation, 1110′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	300	300
Sand, Little Dunkard? (Big Dunkard)	90	390
Unrecorded	295	685
Salt sand (water, 690′)	63	748
Unrecorded	510	1258
Big Lime	82	1340
Big Injun sand	100	1440
Unrecorded	404	1844
Fifty-foot sand (gas, 1847′)	40	1884
Unrecorded	5	1889
Thirty-foot sand	14	1903
Unrecorded	5	1908
Sand, Gordon? (Gordon Stray)	57	1965
Unrecorded to bottom	95	2860

The well starts 150 feet, aneroid, below the Pittsburgh coal.

The following is the record of a comparatively dry hole located along the southern border of Clay district, near the head of Shinns run. The well starts about 100 feet below the Pittsburgh coal. A light show of gas was struck in the Gordon Stray:

S. A. Elliott No. 1 Well Record (643).

Located in Clay District, 1.3 miles southeast of Saltwell. Authority, South Penn Oil Company.

(Elevation, 1030′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	440	440
Big Dunkard sand	70	510
Unrecorded	200	710
Sand, "First Gas"? (II Cow Run) (water, 725′)	43	753
Unrecorded	6	759
Sand, "Second Gas"? (Salt)	27	786
Unrecorded	69	855
Salt sand	130	985
Unrecorded	345	1330
Little lime	7	1337
Unrecorded	7	1344
Big Lime	56	1400
Big Injun sand	96	1496
Unrecorded	410	1906
Fifty-foot sand	35	1941
Unrecorded	44	1985

	Thickness. Feet.	Total. Feet.
Thirty-foot sand	55	2040
Unrecorded	8	2048
Sand, Stray (Gordon Stray) (gas, 2048′)	27	2075
Unrecorded	5	2080
Gordon sand	25	2105
Unrecorded	133	2238
Fifth sand	28	2256
Unrecorded	44	2300
Bayard sand	16	2316
Unrecorded to bottom	356	2672

Farther down Shinns run at Saltwell a boring (644) was sunk in 1835 on the Righter farm by Abraham and P. B. Righter to a depth of 745 feet, in which a light flow of gas and a strong stream of fresh water were encountered. The well starts 55 feet, by aneroid, below the Pittsburgh coal; hence, it probably stopped in the top of the II Cow Run sand. Water is still flowing from the top of the hole, and likewise a small amount of gas is escaping therefrom.

One mile northeastward the L. D. Jarvis Heirs No. 1 well (645) was drilled by Benedum & Trees to a depth of 2550 feet, in which a light flow of gas was encountered in the Big Injun sand. The well mouth is 25 feet below the Pittsburgh coal; hence, the boring penetrated the horizon of the Bayard sand.

The following is the record of a well located in the southwest corner of Clay district, in which a 3,000,000 cubic feet daily flow of gas was encountered in the Big Injun, along with an oil show in the Bayard:

Silas Ogden* No. 1 Well Record (648).

Located in Clay District, 0.9 mile S. 80° E. of Gypsy. Authority, Mandell Oil & Gas Company.

(Elevation, 1040′ B-A. T.)	Thickness Feet	Total Feet.
Unrecorded	115	115
Pittsburgh coal	5	120
Unrecorded	150	270
Cave	40	310
Unrecorded	140	450
Sand, First Cow Run? (Moundsville)	40	490

---

*Vol. I(A), W. Va. Geol. Survey, p. 330; 1904.

	Thickness. Feet.	Total. Feet.
Unrecorded	125	615
Dunkard sand	65	680
Unrecorded	60	740
Sand, Salt? ("Gas") (Gas, 890'; water, 895')	155	895
Unrecorded	315	1210
Red rock	190	1400
Maxton sand	10	1410
Unrecorded	80	1490
Lime	65	1555
Big Injun sand (gas, 1570'-1580')	110	1665
Unrecorded	392	2057
Sand, Fifty-foot (50-ft. and 30-ft)	129	2186
Unrecorded	52	2238
Red rock	5	2243
Sand, Gordon? (Gordon Stray)	27	2270
Unrecorded	274	2544
Bayard sand (oil show, 2545'-2585')	44	2588
Unrecorded to bottom	109	2697

Prospective Oil and Gas Territory, Clay District.—The northern border of Clay district has been quite thoroughly tested for oil and gas, but there still remains in other portions of its area a large acreage that is favored by geologic structure and present development to warrant a further search by the drill for these valuable hydrocarbons. Considering these areas from northwest to southeast, (1) that portion of the district northwestward from Shinnston to Bingamon creek appears favorable for Big Injun, Fifty-foot, and Fifth sand gas, with a chance northeastward from the Ogden oil pool for Fourth sand oil; (2) that, northwestward to West Fork river from the well, the log of which is given last above, for gas in the Big Injun, with a chance for Bayard sand oil in the immediate region of the latter well; (3) that, northeastward from Sugarcamp run of Thomas fork to the Harrison-Taylor county line, for gas in the Fifty-foot; and (4) that, in the extreme southeast corner of Clay to the east of Thomas fork, for gas at the same horizon since the J. F. Holt No. 1 well (634), at the same structural level, three miles northeastward, was a very heavy Fifty-foot sand gasser.

COAL DISTRICT.

Coal district is located in the central portion of Harrison county, and its area is traversed in an almost north and south direction by two structural folds; viz., the Wolf Summit anticline, and the Shinnston syncline. A glance at the structure map accompanying this report will show that its strata are very much warped and disturbed, as the Pittsburgh coal varies in elevation from 950′ A.T., 0.5 mile east of Meadowbrook, to 1225′ A.T. at Wilsonburg, and 1.5 miles westward from Bridgeport. Owing to the convergence southward of the axes of the Wolf Summit and Chestnut Ridge anticlines, the axis of the Shinnston Basin rises rapidly in elevation in the same direction in Harrison county, so that even that portion of Coal district in the low points of the latter syncline occupies a comparatively high structural level when referred to the region along this trough near the mouth of Little Bingamon creek. Thus it happens that the great gas pools accompanying both the anticlines above mentioned are connected across the Shinnston Basin through Coal and Clark districts, making the region surrounding Clarksburg one of the greatest gas fields in the State. The oil and gas development will now be considered from west to east.

The two following records are from wells located near the crest of the Wolf Summit anticline:

Thos. P. Reynolds No. 1 Well Record (661).

Located in Coal District, 1 mile southwest of Wilsonburg. Authority, Washington Gas Company.

(Elevation, 1060′ B-A. T.)	Thickness Feet.	Total Feet.
Unrecorded	300	300
Sand, Little Dunkard (I Cow Run)	40	340
Unrecorded	45	385
Big Dunkard	55	440
Unrecorded	260	700
Sand, First Salt? (Clarion)	56	756
Unrecorded	44	800
Sand, Second Salt? (II Cow Run and Salt)	110	910
Unrecorded	175	1085
Maxton sand	25	1110
Unrecorded	105	1215
Big Lime	95	1310
Big Injun sand	100	1410
Unrecorded	30	1440
Squaw sand	60	1500
Unrecorded	310	1810
Fifty-foot sand	35	1845
Unrecorded	12	1857
Thirty-foot sand	25	1882

	Thickness. Feet.	Total Feet.
Unrecorded	56	1968
Stray sand	14	1982
Unrecorded	20	2002
Gordon sand	18	2020
Unrecorded	65	2085
Fourth sand	55	2140
Unrecorded	100	2240
Fifth sand (gas pay, 2244′ and 2250′)	25	2265

6⅝″ casing, 1228′; 5 3/16″ casing, 2130′. "Production, 2,500,000 cu. ft. daily."

The well starts 125 feet below the Pittsburgh coal.

T. F. Gifford No. 2102 Well Record (658).

Located in Coal District, 1.5 miles northeast of Wilsonburg. Authority, Philadelphia Company.

(Elevation, 1405′ B-A. T.)	Thickness Feet.	Total Feet.
Unrecorded	251	251
Pittsburgh coal	9	260
Unrecorded	490	750
Big Dunkard sand	60	810
Unrecorded	90	900
Sand, Salt? ("Gas" and II Cow Run)	205	1105
Unrecorded	65	1170
Salt sand	80	1250
Unrecorded	70	1320
Sand, Maxton? (Salt)	55	1375
Unrecorded	246	1621
Big Lime	49	1670
Big Injun sand (gas, 1712′)	105	1775
Unrecorded	415	2190
Sand, Thirty-foot? (Fifty-foot) (gas, 2208′)	25	2215
Unrecorded	22	2237
Sand, Gordon Stray? (Thirty-foot) (gas, 2239′ and 2267′)	33	2270
Unrecorded	25	2295
Sand, Gordon? (Gordon Stray)	17	2312
Unrecorded	150	2462
Fourth sand (gas, 2478′ and 2493′)	48	2510
Unrecorded	113	2623
Fifth sand (gas, 2629′)	11	2634
Slate to bottom	21	2655

The log of the S. E. Hamrick No. 1145 well (657), located near the head of Crooked run, is published in connection with the section for N. E. of Wilsonburg, page 110. Northward from Clarksburg to Farnum in Coal district the bottom portion of the Shinnston Basin suddenly flattens southward and enlarges to a width of 3 to 4 miles, forming a high structural terrace on which there occur many gas wells along both banks of West Fork river. The four following records from this locality contain much data of interest:

John Q. McIntyre No. 1 Well Record (652).

Located in Coal District, 0.4 mile north of Farnum. Authority, Hope Natural Gas Company.

(Elevation, 975′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1383	1383
Big Injun sand	120	1503
Unrecorded (gas in Fifty-foot sand)	609	2112
Gordon sand	13	2115
Unrecorded	265	2380
Fifth sand (gas) to bottom	16	2396

The well starts 45 feet, by aneroid, below the Pittsburgh coal.

Moses Tichenall No. 1 Well Record (655).

Located in Coal District, 1 mile north of Adamston on west bank of river. Authority, Clarksburg Light and Heat Company. Completed September 26, 1910.

(Elevation, 925′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	390	390
Sand, Little Dunkard (I Cow Run)	30	420
Unrecorded	100	520
Sand, Big Dunkard? (Burning Springs)	30	550
Unrecorded	50	600
Gas sand	50	650
Unrecorded	70	720
Salt sand	154	874
Unrecorded	222	1096
Maxton sand	20	1116
Unrecorded	99	1215
Little lime	12	1227
Pencil cave	10	1237
Big Lime	63	1300
Big Injun sand (gas, 1310′)	111	1411
Unrecorded	389	1800
Sand, Berea? (Gantz)	30	1830
Fifty-foot sand	100	1930
Unrecorded	20	1950
Sand, Thirty-foot	20	1970
Unrecorded	150	2120
Sand, Stray 15′ Unrecorded 5 Sand, Gordon? 20 } (Fourth)	40	2160

	Thickness. Feet.	Total. Feet.
Unrecorded	45	2205
Sand, Fourth? (local)	10	2215
Unrecorded	46	2261
Fifth sand (gas, 2264') to bottom	44	2305

The well starts 135 feet, by aneroid, below the Pittsburgh coal.

Smith and Cole No. 1 Well Record (655A).

Located in Coal District, 1 mile north of Clarksburg. Authority, Pennsylvania Oil & Gas Company. Completed Nov. 8, 1909.

	Thickness. Feet.	Total. Feet.
Unrecorded	1290	1290
Big Lime	65	1355
Big Injun sand	110	1465
Unrecorded	345	1810
Sand, Thirty-foot? (Gantz and Fifty-foot) (gas, 1890') and unrecorded	502	2312
Fifth sand (gas, 2324'-2338')	30	2342
Unrecorded to bottom	24	2364

10" casing, 185'; 8¼" casing, 670'; 6⅝" casing, 1356'; 3" tubing, 2364'. Packer set at 1380'.

"Initial gas volume, 4,000,000 cubic feet daily."

According to the owners of the above well, their Pritchard No. 1 (663) had an initial gas volume of 7 million cu. ft. daily.

Lyons No. 1 Well Record (663A).

Located in Coal District, 1 mile north of Clarksburg. Authority, Pennsylvania Oil & Gas Company. Completed April 28, 1910.

		Thickness. Feet.	Total. Feet.
Unrecorded		25	25
Pittsburgh coal		8	33
Unrecorded		787	820
Sand, First Salt? (II Cow Run)		60	880
Unrecorded		70	950
Second Salt sand		50	1000
Unrecorded (gas, 1355')		360	1360
Big Injun sand (gas, 1545')		240	1600
Unrecorded		320	1920
Sand, Gantz 20' Unrecorded 15 Sand, Fifty-foot 15	(Gantz)	50	1970
Unrecorded		15	1985
Sand, Thirty-foot? (Fifty-foot) (gas, 2014') and unrecorded to bottom		49	2034

10" casing, 153'; 8¼" casing, 760'; 6⅝" casing, 1010'; 3" tubing, 2034'. Packer set at 1367'.

"Initial gas volume, 5,000,000 cu. ft. daily."

The log of the Moses Tichenall No. 1 well (655) above shows the Fifty-foot sand in this locality, coming 1960′ below the Pittsburgh coal; hence, the gas horizon in the Lyons well (663A) must represent that sand, and not the Thirty-foot as given by the driller.

The detailed log of the Dick Smith No. 1 well (668), located on the west bank of Simpson creek, 2 miles southeast of Meadowbrook, was published on page 330 of Vol. I(A) of the State Geological reports. It reports gas in the Big Injun and Gordon, and an oil show in the Bayard sand.

On Jack run northward from Clarksburg, where the latter stream intersects the axis of the Shinnston Basin, there occur two or three wells in which a good showing of oil was encountered in the Bayard sand. The detailed record of one of these borings; viz., Robt. W. Coon No. 1 (665), is published in connection with the Two Miles N. of Clarksburg section, page 112. This well reports two barrels of oil daily from a sand 2465 feet below the Pittsburgh coal and 60 feet below the base of the Fifth sand. The record notes a show of black oil in the I Cow Run, and gas in the Fifth sand.

The record of the N. M. Talbott No. 1 well (666) from this Bayard sand oil pool, was published on page 329 of Vol. I(A) of the State Geological reports. This well starts 5 feet below the Pittsburgh coal, and its log reports the Bayard sand at a depth of 2450 feet. A gas pay was encountered near the top of the latter sand, and an oil show near the bottom of the same horizon.

Southeastward on Murphy run there occurs a gas well on the land of the Consolidation Coal Company. It was not learned at what horizon the gas was encountered.

Prospective Oil and Gas Territory, Coal District.—The western portion of Coal district has been quite thoroughly tested and found very prolific gas territory, but there remains a considerable acreage in the central and eastern parts of the district that is favored both by development and geologic structure to a degree sufficient to warrant the drilling of many more wells. (1) That portion of the district immediately northwestward from Adamston to Crooked run appears good for Big Injun, Fifty-foot and Fifth sand gas; and (2) that, northeastward from Clarksburg, and westward from Murphy run, for gas at the same horizons, with a chance for Bayard sand oil in the immediate vicinity of the Jack run pool, and northward therefrom along the axis of the Shinnston Basin to the Coal-Simpson district line.

CLARK DISTRICT.

Clark district lies directly south of Coal district, and it is traversed by the same structural folds as the latter area; viz., the Wolf Summit anticline and the Shinnston syncline; hence, its strata are very much warped and disturbed. A glance at the structure map accompanying this report will show the Pittsburgh coal varying in elevation from 1080′ A.T. at the east edge of Clarksburg to over 1350′ A.T., 1 mile north of Quiet Dell. Owing to its high structural level and to practically the same conditions prevailing as that mentioned in the introductory discussion of Coal district, the entire area of Clark appears favorable for gas, as no wells producing oil have yet been drilled within its boundaries. The development will now be considered from west to east.

Near the crest of the Wolf Summit Arch on the waters of Simpson fork and Davisson run, 30 to 40 gas wells have been drilled. The main gas horizons are the Big Injun, Gordon and Fifth sands. The following is a record of one of these wells:

B. W. Brown No. 1 Well Record (671).

Located in Clark District, 1¼ miles south 70° east of Wilsonburg. Authority, Reserve Gas Company.

(Elevation, 990′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1260	1260
Big Injun sand	60	1320
Unrecorded	702	2022
Gordon sand (gas)	20	2042
Unrecorded	159	2201
Fifth sand (gas)	38	2239
Unrecorded to bottom	3	2242

The well starts 150 feet, by aneroid, below the Pittsburgh coal.

The detailed record of the Hattie Porter No. 1 well, located one mile south of Wilsonburg, is published in connection with the South of Wilsonburg section, page 115. Gas is reported in the Salt, Big Injun and Gordon Stray sands.

The two following records are from wells located just on the east side of the axis of the Shinnston syncline, on the waters of Elk creek:

W. G. Kester No. 1 Well Record (678).

Located in Clark District, 2 miles S. 30° E. of Clarksburg. Authority, Graselli Chemical Company.

(Elevation, 995' B-A. T.)	Thickness. Feet.	Total. Feet.
Conductor	8	8
Lime	65	73
Sand, (Grafton)	107	180
Slate	29	209
Lime	90	299
Sand, (I Cow Run)	20	319
Lime	40	359
Soft lime and slate	251	610
Gas sand	90	700
Slate and shells	85	785
Lime, sandy	35	820
Lime	70	890
Sand, (Salt)	50	940
Lime	12	952
Slate and shells	40	992
Lime, soft	80	1072
Sand, (Maxton)	18	1090
Red rock	40	1130
Lime	60	1190
Red rock	35	1225
Slate	30	1255
Lime ....95' Lime ....97 } (Big Lime)	192	1447
Big Injun sand	78	1525
Red rock	35	1560
Lime	40	1600
Slate and shells	30	1630
Sand, (Squaw)	25	1655
Slate and shells	206	1861
Sand, (Gantz)	35	1896
Slate	5	1901
Sand, (Fifty-foot and Thirty-foot)	186	2087
Red rock	128	2215
Sand, (Fourth)	36	2251
Red rock	35	2286
Slate and shells	88	2374

	Thickness. Feet.	Total. Feet.
Fifth sand (light gas and oil show)	35	2409
White slate	97	2506

The well starts 5 feet above the Little Clarksburg coal.

Angeline Ash No. 1 Well Record (680).

Located in Clark District, 1 mile southeast of Clarksburg. Authority, Clarksburg Light and Heat Company. Completed Oct. 16, 1909.

(Elevation, 960′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	300	300
Sand, Little Dunkard (I Cow Run)	20	320
Unrecorded	80	400
Big Dunkard sand	20	420
Unrecorded	260	680
Sand, First Salt? (II Cow Run and Salt)	145	725
Unrecorded	50	775
Salt sand	75	850
Unrecorded	490	1340
Little lime	10	1350
Pencil cave	10	1360
Big Lime	60	1420
Big Injun sand (gas, 1430′)	105	1525
Unrecorded	347	1872
Sand, Fifty-foot? (Gantz, 50-ft. and 30-ft.) (gas and water, 1874′)	208	2080
Red rock and shells	100	2180
Sand, Fourth (Gordon)	12	2192
Red rock and shells	181	2373
Fifth sand (gas, 2378′) to bottom	16	2389

The well starts 115 feet by aneroid below the Pittsburgh coal.

In the extreme southeast corner of Clark district there occur two wells (676 and 677) that appear to be gassers in the Fifth sand. The detailed log of one of these borings; viz., John Cost No. 1 (676), is published in connection with the Quiet Dell section, page 117.

Prospective Oil and Gas Territory, Clark District.—As mentioned in the introductory discussion of this district, practically the whole area of Clark appears favorable for gas at some horizon down to and including the Fifth sand. (1) That portion of the district to the south, west and northwest of the mouth of Davisson run, warrants the drilling of several more wells for gas; (2) that, drained by Arnold and Dull runs also appears good for gas; and (3) all that part of the district south of the 39° 15′ parallel of North Latitude, for gas.

SIMPSON DISTRICT.

Simpson district lies along the eastern border of Harrison county, south from Clay, and it is traversed by four structural folds; viz., the Chestnut Ridge and Beards Run anticlines, and the Shinnston and Grassland synclines. Its strata are even more warped and disturbed than that in the other districts heretofore described. A glance at the structure map accompanying this report will show much relief prevailing therein. Although several gas wells already occur within its boundaries, yet this district has not been so thoroughly tested as other portions of the county.

The following is the record of a Fifty-foot sand oil well, located on Barnett run. The production of the well was not learned, but it was in sufficient quantity to justify saving the oil:

Morgan R. Lodge No. 1 Well Record (683).

Located in Simpson District, 2 miles N. 15° W. of Bridgeport. Authority, South Penn Oil Company.

(Elevation, 990′ L-A. T.)	Thickness Feet.	Total Feet.
Unrecorded	1340	1340
Big Injun sand	65	1405
Unrecorded (oil in Fifty-foot sand)	570	1975
Gordon sand	15	1990
Unrecorded	130	2120
Fifth sand	10	2130
Unrecorded to bottom	390	2520

The well starts 203 feet by hand-level below the Pittsburgh coal.

The same company drilled a dry hole during 1910, one mile northward from the above well, of which the following is a record:

Morgan R. Lodge No. 2 Well Record (682).

Located in Simpson District, 2¾ miles N. 10° W. of Bridgeport. Authority, South Penn Oil Company.

	Thickness Feet.	Total Feet.
Unrecorded	1470	1470
Big Injun sand	100	1570
Unrecorded	495	2065
Gordon sand	25	2090
Unrecorded	190	2280
Fifth sand	5	2285
Unrecorded to bottom	186	2471

"Dry well."

The following is the record of a dry hole on the head of Thomas Fork of Booths creek, in the northeast corner of the district. The log fails to report the Bayard sand, although drilled 325 feet below the Fifth sand:

John Nuzum No. 1 Well Record (684).

Located in Simpson District, 1 mile southeast of McAlpin. Authority, Hope Natural Gas Company.

(Elevation, 1110′ B-A. T.)	Thickness Feet.	Total Feet.
Unrecorded	1270	1270
Big Injun sand	130	1400
Unrecorded	775	2175
Fifth sand	40	2215
Unrecorded to bottom	325	2540

"Dry in all sands."

The well starts about 240 feet below the Pittsburgh coal.

Several gas wells have been drilled in the region immediately surrounding Bridgeport. The five following records give interesting data as to the gas horizons, and the coal beds penetrated:

Jesse H. Willis No. 1 Well Record (686).

Located in Simpson District, ¾ mile north of Bridgeport. Authority, Clarksburg Oil & Gas Company.

(Elevation, 1050′ B-A. T.)	Thickness Feet.	Total Feet.
Unrecorded	155	155
Coal, (Bakerstown)	7	162
Unrecorded	108	270
Coal, (Brush Creek)	7	277

	Thickness. Feet.	Total. Feet.
Unrecorded	193	470
Coal, (Upper Kittanning)	(11)	(481)
Unrecorded	804	1285
Big Injun sand (gas, 1290') and unrecorded to bottom	957	2242

"Initial daily gas volume, 1,000,000 cu. ft.; rock pressure, 600 lbs."

The well starts about 260 feet below the Pittsburgh coal.

The coals reported in this boring are without doubt mostly black slate, since a coal test boring (690) by Payne and Brady on the Sandusky farm, 1.7 miles southeastward, obtained only thin streaks of coal at the horizons of the Brush Creek and Upper Kittanning, while the Bakerstown only a few inches thick, crops 10 to 20 feet above the well mouth.

Miss C. N. Johnson No. 1 Well Record (687).

Located in Simpson District, ½ mile south of Bridgeport. Authority, Bridgeport Natural Gas and Oil Company.

	Thickness Feet.	Total Feet.
Unrecorded	275	275
Sand, Little Dunkard? (Big Dunkard)	35	310
Unrecorded	60	370
First Gas sand	70	440
Unrecorded	30	470
Second Gas sand	80	550
Unrecorded	30	580
Sand, Third Gas? (II Cow Run)	25	605
Unrecorded	30	635
Salt sand	65	700
Unrecorded	100	800
Salt sand	70	870
Unrecorded	335	1205
Maxton sand (gas, 1203')	20	1225
Big Lime	60	1285
Big Injun sand	90	1375
Unrecorded	365	1740
Fifty-foot sand	207	1947
Unrecorded	183	2130
Sand, Fifth	10	2140
Unrecorded	120	2260
Bayard sand	35	2295
Unrecorded to bottom	15	2310

10" casing, 125'; 6" casing, 1175'; 2" casing, 2310'.

Jesse H. Willis No. 3 Well Record (688).

Located in Simpson District, ¾ mile northeast of Bridgeport. Authority, Bridgeport Natural Gas & Oil Company.

(Elevation, 988' L-A. T.)

	Thickness Feet.	Total Feet.
Unrecorded	133	133
Coal, (Brush Creek)	3	136

	Thickness. Feet.	Total. Feet.
Unrecorded	49	185
Sand, Little Dunkard? (Big Dunkard)	43	228
Unrecorded	2	230
Coal, (Upper Freeport)	4	234
Unrecorded	6	240
Sand, Big Dunkard? (Burning Springs)	50	290
Unrecorded	10	300
Gas sand	40	340
Unrecorded	10	350
Coal, (Upper Kittanning)	6	356
Unrecorded	4	360
Coal, (Middle Kittanning)	5	365
Unrecorded	3	368
Sand, First Salt? (Clarion) (water, 399')	66	434
Unrecorded	24	458
Sand, Second Salt? (II Cow Run) water, 480')	20	478
Unrecorded	47	525
Sand, (Salt)	47	572
Unrecorded	48	620
Sand (Salt) (water and gas, 650')	70	690
Unrecorded	110	800
Red rock	165	965
Sand, (Maxton)	65	1030
Red rock	25	1055
Unrecorded	29	1084
Little lime	10	1094
Pencil cave	20	1114
Unrecorded	6	1120
Sand, Blue Monday (gas, 1122')	4	1124
Unrecorded	4	1128
Big Lime	55	1183
Unrecorded	4	1187
Big Injun sand (water, 1288')	113	1300
Unrecorded	345	1645
Sand, Fifty-foot? (50-ft., 30-ft. and Stray) (gas, 1698')	235	1880
Red rock and unrecorded	300	2180
Bayard sand (oil show, 2195')	32	2212
Unrecorded to bottom	10	2222

10" casing, 95'; 8" casing, 572'; 6⅝" casing, 1133'; 5$\frac{3}{16}$" casing 1651'.

The well starts 55 feet by aneroid below the Harlem coal.

The coals reported in the foregoing record are doubtless more than half black slate, and the same is true of the Clarion coal reported from the following drill hole:

Bridgeport Saw and Planing Mill Company
No. 1 Well Record (689).

Located in Simpson District, in Bridgeport. Authority, Bridgeport Natural Gas and Oil Company.

(Elevation, 970' B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	67	67
Coal, (Bakerstown)	2	69
Unrecorded	86	155
Coal, (Brush Creek)	5	160
Unrecorded	170	330
Sand, Big Dunkard? ("Gas")	50	380
Unrecorded	50	430
Coal, (Clarion)	10	440
Unrecorded	840	1280
Big Injun sand	70	1350
Unrecorded	100	1450
Squaw sand	153	1603
Unrecorded	222	1825
Sand, (30-ft., Stray and Gordon)	155	1980
Unrecorded to bottom	242	2222

"Gas in Bayard sand, 200,000 cu. ft.; rock pressure, 500 lbs."

10" casing, 100'; 8" casing, 685'; 6¼" casing, 1150'. Packed at 1192' in Big Lime.

The well starts 32 feet by hand-level below the Harlem coal.

The detailed record of the J. R. Stout No. 1 well (685), located 1.2 miles north of Bridgeport, is published in connection with the section for the latter place, page 119.

Southeastward on the crest of the Chestnut Ridge anticline, the Hope Natural Gas Company drilled the Hampton Lang No. 1 dry hole (695), located 1.8 miles northeast of Quiet Dell. This well starts over 200 feet below the horizon of the Pittsburgh coal, and is reported to have reached a depth of about 2300 feet.

Three-fourths mile southwestward, the same company drilled a gas well (696) on the Strother Stout farm, nearly on the axis of the same structural fold. It was not learned at what horizon the gas was encountered, but it was probably in the Big Injun, or Thirty-foot, as this company reports the Chas. J. Roy No. 1 well (697), 0.9 mile eastward, a gasser at the same horizons.

Three miles eastward in the low gap between Coplin and Pigtail runs, the Hope Natural Gas Company drilled a dry hole (699) nearly on the crest of the Beards Run anticline.

The following record of this well, with modifications in parentheses by the writer, is taken from page 291 of Bulletin No. 298 of the U. S. Geol. Survey.

George Lancaster No. 1 Well Record (699).

Located in Simpson District, 1.8 miles northeast of Grassland. Authority, Hope Natural Gas Company.

(Elevation, 1365′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	42	42
Coal, Pittsburgh	6	48
Unrecorded	520	568
Dunkard sand	32	600
Unrecorded	75	675
Gas sand	35	710
Unrecorded	320	1030
Salt sand (Maxton)	60	1090
Unrecorded	180	1270
Big Lime?	70	1340
Sand, Big Injun?	140	1480
Unrecorded	298	1778
Sand, Fifty-foot? Squaw?	42	1820
Unrecorded	200	2020
Sand, Stray (Fifty-foot)	25	2045
Unrecorded	25	2070
Sand, Gordon? Nineveh? (Thirty-foot)	15	2085
Unrecorded	270	2355
Sand, Fifth (Fourth)	20	2375
Unrecorded	125	2500
Lime and shells	500	3000
Lime, sand and shells	280	3280
Unrecorded	5	3285
Sand (salt water at 3295) (Speechley?)	25	3310
Black slate	10	3320
Hard lime	20	3340
Black slate	31	3371

10″ casing, 270′; 8¼″ casing, 1400′. Dry hole.

The coal at 42 feet undoubtedly represents the Pittsburgh bed, since the latter crops about this distance below the well mouth; hence, it appears the drillers have erred in their correlation of the Big Injun sand, as the top of the latter belongs about 1550 feet below the Pittsburgh coal in wells 3 miles northwestward and 2 miles southwestward.

Two miles southwestward from the latter well, near Grassland, the Tri-State Gas Company drilled the deepest well in the Doddridge-Harrison area, the detailed log of which is published in connection with the Grassland section, page 120. The record reports a little gas in the Chemung and Portage beds at a depth of 2950 feet, 3125 feet below the Pittsburgh coal.

The following is the record of a well drilled by the South Penn Oil Company a short distance up the western slope of the Grassland syncline, in which sufficient gas was encountered in the Big Injun sand to provide the fuel for the completion of the well. It starts 10 feet below the Elk Lick coal, and 260 feet below the Pittsburgh bed:

L. L. Long No. 1 Well Record (698).

Located in Simpson District, 1.2 miles westward from Grassland. Authority, G. M. Allender.

(Elevation, 1020′ B-A. T.)	Thickness Feet.	Total Feet.
Unrecorded	150	150
Sand, Little Dunkard (I Cow Run)	40	190
Unrecorded	290	480
Gas sand	70	550
Unrecorded	100	650
Salt sand	150	800
Unrecorded	230	1030
Maxton sand	70	1100
Unrecorded	80	1180
Big Lime	67	1247
Big Injun sand (gas, 1267′)	63	1310
Unrecorded	5	1315
Red rock	15	1330
Sand, Stray? (Squaw)	35	1365
Unrecorded	365	1730
Sand, Fifty-foot (50-ft. and 30-ft.)	110	1840
Unrecorded	55	1895
Gordon sand	15	1910
Red sand	35	1945
Unrecorded	55	2000
Fourth sand	45	2045
Unrecorded	128	2173
Fifth sand	22	2195
Unrecorded to bottom (no sands)	330	2525

10″ casing, 130′; 8″ casing, 1151′; 6⅝″ casing, 1621′.

Prospective Oil and Gas Territory, Simpson District.—Although the structural conditions are ideal over a large portion of Simpson district for the accumulation of large pools of natural gas, yet several test wells, scattered over its area, especially in the southeast half, have proved rather disappointing to the operator. A glance at the economic geology map accompanying this report, will show the location of these wells, the most of which have been referred to in the foregoing pages. However, it has been learned by experience that a single dry hole does not actually condemn a very large acreage of the immediately surrounding territory, since it often happens that such a well occurs in the midst of an oil pool, due to a local hardening of the sand; hence, in the writer's judgment, there yet remains a large acreage in Simpson that warrants the drilling of more test wells. These areas will now be considered from northwest to southeast in the district.

(1) That territory along the axis of the Shinnston Basin, eastward from Meadowbrook, appears favorable for Big Injun gas with a chance for Bayard sand oil, in view of the fine showing of the Silas Ogden No. 1 well (648) to the northward in the same Basin; (2) that, northeastward from Simpson creek to the Simpson-Clay district line, between the 1000 and 1100-foot contours of the Pittsburgh coal as outlined on the structure map accompanying this report, for gas in the Big Injun, with a chance for oil or gas in the Fifty-foot, Gordon and Bayard sands; (3) that, on Barnett run, immediately to the northeast and southwest of the Morgan R. Lodge No. 1 well (683), for oil in the Fifty-foot sand; (4) that, along the crest of the Chestnut Ridge anticline southwestward from the Taylor-Harrison county line to the 39° 15′ parallel of N. Latitude, for gas in the Maxton, Big Injun, Fifty-foot, and Bayard sands; and (5) that, drained by the waters of Beards run southwest of Tyrconnell Mines, for gas with a chance for oil on account of the terrace structure prevailing at this place.

GRANT DISTRICT.

Grant district lies along the southern border of Harrison county, on the east of and adjoining West Fork river. Its area is traversed by three structural folds; viz., the Wolf Summit and Chestnut Ridge anticlines, and the Shinnston syncline. By far the greater portion lies within the latter

Basin. A glance at the structure map accompanying this report will show that much relief prevails therein, and that the entire area of the district occupies a high structural level, due to the convergence southward of the axes of the above-mentioned anticlines, the latter feature causing the rapid rise southward of the axis of the Shinnston Basin across the county; hence, as should be expected, almost the whole of Grant is valuable gas territory.

The greatest development has taken place on Browns run; in the region immediately to the west of the axis of the Chestnut Ridge Arch; and along West Fork river on and near the crest of the Wolf Summit fold.

In the north pan-handle of Grant, 15 to 20 gas wells have already been drilled on the waters of Browns run. A number of the same are grouped around Byron, the detailed record of one of which; viz., Claude Davisson No. 1 (701), is published in connection with the Byron section, page 122. This well is a heavy gasser from the Fifth sand.

The following record is from a Fifth sand gasser near the head of Browns run:

Levi Paugh No. 1352 Well Record (704).

Located in Grant District, 2 miles southeast of Byron. Authority, Hope Natural Gas Company.

(Elevation, 1176′ L-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1410	1410
Big Injun sand	95	1505
Unrecorded	785	2290
Fifth sand (gas)	22	2312
Unrecorded to bottom	3	2315

The well starts 150 feet below the Pittsburgh coal.

Southward in the region immediately northeast and southwest of Lost Creek station, a large number of heavy gas wells have been drilled recently. The eleven following records from wells in this locality contain much valuable data concerning both the gas and the coal beds penetrated by the boring:

Seventh Day Baptist Church Lot Well Record (705).

Located in Grant District, ¾ mile northeast of Lost Creek. Authority, Lost Creek Oil and Gas Company. Completed June 5, 1910.

(Elevation, 1070′ L-A. T.)	Thickness. Feet.	Total. Feet.
Clay, etc	58	58
Sand (water) (Moundsville)	28	86
Coal, (Bakerstown)	33	119
Sand	96	215
Coal, (Brush Creek)	5	220
Sand (Big Dunkard)	31	251
Shale	169	420
Sand, Big Dunkard? ("Gas")	40	460
Shale (water, 425′)	5	465
Coal, (Clarion)	7	472
Shale	18	490
Sand, (II Cow Run)	30	520
Shale	50	570
Sand	40	610
Shale	30	640
Salt sand (water, 670′)	65	705
Sand	25	730
Coal, (Quakertown)	3	733
Sand	2	735
Lime	11	746
Shale	64	810
Sand, (Salt)	65	875
Shale	5	880
Sand (pocket of gas at 890′) (Salt)	80	960
Red rock	24	984
Lime	6	990
Sand, (Maxton)	50	1040
Red rock	85	1125
Black slate	45	1170
Little lime	10	1180
Pencil cave	20	1200
Big Lime	60	1260
Sand, Big Injun (gas, 1280′)	140	1400
White slate	20	1420
Gritty lime	18	1438
Slate and shells	22	1460
Lime	163	1623
Gantz sand (gas, 1625′-1640′)	80	1703
Black slate	5	1708
Fifty-foot sand (oil and water, 1723′ to 1730′)	22	1730
Sand	34	1764
Sand	8	1772
Black slate	3	1775
Sand, Thirty-foot	35	1810
Slate and shells	20	1830
Hard sand, (Gordon Stray)	28	1858
Red rock	75	1933
Sand, Gordon	17	1950
Red rock	38	1988
Fourth sand	27	2015

	Thickness. Feet.	Total. Feet.
Shells	15	2030
Hard sand (local)	20	2050
Slate and shells	45	2095
Slate	57	2152
Fifth sand (gas, 2158′)	34	2186
Slate to bottom	7	2193

The well starts about 300 feet below the Pittsburgh coal.

According to G. M. Gribble, an interested party in the well, it would have pumped 15 to 25 barrels of oil daily from the Fifty-foot sand.

Seventh Day Baptist Church Lot No. 1 Well Record (706).

Located in Grant District, at Lost Creek. Authority, Pennsylvania Oil & Gas Company.

(Elevation, 1020′ B-A. T.)	Thickness Feet.	Total Feet.
Unrecorded (water, 20′ and 180′)	200	200
Sand, Little Dunkard? (Big Dunkard)	50	250
Unrecorded	50	300
Sand, Big Dunkard? (Burning Springs)	50	350
Unrecorded	70	420
Gas sand	35	455
Unrecorded	140	595
Salt sand	50	645
Unrecorded (water, 656′)	64	709
Salt sand	96	805
Unrecorded	308	1113
Little lime	13	1126
Unrecorded	24	1150
Pencil cave	3	1153
Big Lime	53	1206
Big Injun sand	118	1324
Unrecorded	221	1545
Sand, Gantz? (Berea) (gas, 1545′)	25	1570
Unrecorded	80	1650
Fifty-foot sand	75	1725
Unrecorded	54	1779
Thirty-foot sand	6	1785
Unrecorded	143	1928
Sand, Gordon Stray? (Gordon)	11	1939
Unrecorded	20	1959
Sand, Gordon? (Fourth)	25	1984
Unrecorded	93	2077
Fifth sand (gas, 2092′)	28	2105
Unrecorded to bottom	5	2110

The well starts 20 feet below the Harlem coal and 350 feet below the Pittsburgh bed.

I. M. Swisher No. 1 Well Record (719).

Located in Grant District, 0.7 mile northwest of Lost Creek. Authority, Tri-State Gas Company.

(Elevation, 1160′ B-A. T.)	Thickness Feet.	Total Feet.
Unrecorded	100	100
Sand, Murphy? (Grafton) (water, 165′)	65	165
Unrecorded	135	300
Sand, Little Dunkard? (Big Dunkard)	77	377
Unrecorded	33	410
Sand, Big Dunkard (Burning Springs, Gas and II Cow Run)	315	725
Unrecorded	27	752
Sand, "Gas"? (Salt)	66	818
Unrecorded	7	825
Salt sand	120	945
Unrecorded	115	1060
Maxton sand	80	1140
Unrecorded	130	1270
Little lime	20	1290
Pencil cave	10	1300
Big Lime (hole full of water)	62	1362
Unrecorded	8	1370
Big Injun sand	120	1490
Unrecorded	10	1500
Squaw sand	65	1565
Unrecorded	240	1805
Sand, Fifty-foot (Gantz and 50-ft.)	100	1905
Unrecorded	35	1940
Sand, (Thirty-foot)	25	1965
Unrecorded	25	1990
Gordon Stray sand	20	2010
Unrecorded	60	2070
Gordon sand	40	2110
Unrecorded	195	2305
Fifth sand (gas, 2310′)	29	2334
Unrecorded to bottom	8	2342

The well starts 165 feet below the horizon of the Pittsburgh coal.

L. M. Bassell No. 3 Well Record (732D).

Located in Grant District, ¼ mile northwest of Lost Creek. Authority, Tri-State Gas Company.

	Thickness. Feet.	Total. Feet.
Unrecorded	620	620
Salt sand (water, 680′)	115	735
Unrecorded	325	1060
Red rock	105	1165
Unrecorded	70	1235
Big Lime	65	1300
Big Injun sand (water and gas, 1325′)	121	1421

	Thickness. Feet.	Total. Feet.
Unrecorded	221	1642
Sand, Gantz? (Berea) (water and gas, 1645′)	28	1670
Unrecorded	55	1725
Sand, Fifty-foot (Gantz and 50-ft.) (½ bailer of water per hour)	68	1793
Unrecorded	57	1850
Thirty-foot sand	42	1892
Unrecorded	120	2012
Sand, Gordon Stray? 13′ } (Fourth)	38	2050
Unrecorded 2		
Sand, Gordon 23		
Unrecorded	120	2170
Fifth sand (gas, 2172′)	22	2192
Unrecorded to bottom	11½	2203½

Bassell Heirs No. 2 Well Record (732B).

Located in Grant District, 0.3 mile southwest of Lost Creek. Authority, Tri-State Gas Company.

	Thickness. Feet.	Total. Feet.
Unrecorded	450	450
Sand, Big Dunkard ("Gas")	60	510
Unrecorded	215	725
Sand, "Gas" (Salt)	40	765
Unrecorded	32	797
Salt sand	148	945
Unrecorded	145	1190
Big Lime	85	1275
Big Injun sand	115	1390
Unrecorded	201	1591
Sand, Gantz? (Berea) (gas, 1605′-1617′)	26	1617
Unrecorded (water, 1619′-1655′)	38	1655
Slate and shells	35	1690
Fifty-foot sand	30	1720
Slate and shells	80	1800
Thirty-foot sand	40	1840
Red rock	130	1970
Sand, Stray? (Gordon)	25	1995
Unrecorded	8	2003
Sand, Gordon? (Fourth) (water, 2011′)	41	2044
Unrecorded	94	2138
Fifth sand	32	2170
Unrecorded to bottom	45	2215

"Tubed with 1617′ of 4″ Anchor Packer set 43′ from bottom. Abandoned."

Bassell Heirs No. 1 Well Record (732A).

Located in Grant District, 0.4 mile southwest of Lost Creek. Authority, Tri-State Gas Company.

	Thickness. Feet.	Total. Feet.
Unrecorded	26	26
Fine water well in lime, and unrecorded	24	50
Fine water well in sand and unrecorded	66	116

	Thickness. Feet.	Total. Feet.
Coal, (Bakerstown)	2	118
Unrecorded	37	155
Sand	5	160
Unrecorded	40	200
Sand, (Big Dunkard)	31	231
Unrecorded	104	335
Coal, (Upper Kittanning)	3	338
Unrecorded	27	365
Sand	40	405
Coal, (Lower Kittanning)?	4	409
Unrecorded	151	560
Sand, (Salt)	88	648
Unrecorded	67	715
Sand, (Salt)	35	750
Unrecorded	15	765
Sand	35	800
Unrecorded	10	810
Sand (Salt) (hole full of water, 885')	75	885
Unrecorded	5	890
Sand	30	920
Unrecorded	15	935
Red rock and slate	255	1190
Big Lime (hole full of water, 1220')	95	1285
Big Injun sand	100	1385
Unrecorded	183	1567
Sand, Gantz? (Berea) (first gas pay, 1570'; second pay, 1583') and unrecorded to bottom	20	1587

"Tubed with 1587' of 4" Anchor Packer set 47' from bottom."

The drillers in this region mistake the Berea sand for the Gantz.

John H. Hardway No. 1 Well Record (716).

Located in Grant District, 0.8 mile S. 10° W. of Lost Creek. Authority, Graselli Chemical Company.

(Elevation, 1080' B-A. T.)	Thickness Feet.	Total Feet.
Conductor	16	16
Slate	40	56
Coal, (Harlem)	3	59
Slate	30	89
Lime	25	114
Slate	56	170
Lime	15	185
Slate	35	220
Lime	40	260
Sand	10	270
Lime	110	380
Coal, (Upper Kittanning)	6	386
Lime	49	435
Little sand ("Gas")	35	470
Slate	44	514

	Thickness. Feet.	Total. Feet.
Lime	20	534
Slate	10	544
Lime	38	582
Sand, (Salt)	35	617
Slate	13	630
Lime	5	635
Sand, (Salt)	81	716
Slate	26	742
Sand, (Salt)	53	795
Slate	4	799
Sand	10	809
Slate	25	834
Sand	36	870
Slate	5	875
Sand (Salt)	113	988
Red rock	15	1003
Lime	30	1033
Rock	73	1106
Slate	35	1141
Lime	41	1182
Slate	14	1196
Big Lime	104	1300
Big Injun sand	100	1400
Slate	140	1540
Lime	35	1575
Slate	20	1595
Sand, Gantz? (Berea) (gas)	45	1640

J. N. Rector No. 1 Well Record (717A).

Located in Grant District, ¾ mile southwest of Lost Creek. Authority, Tri-State Gas Company.

(Elevation, 1155′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	345	345
Sand, Dunkard (I Cow Run)	20	365
Unrecorded	115	480
Coal, (Lower Freeport)	2	482
Unrecorded	41	523
Gas sand	48	571
Unrecorded	57	628
Sand	20	648
Lime	30	678
Sand, First Salt? (II Cow Run)	30	708
Break	15	723
Salt sand (water, 775′, 6 bailers)	67	790
Unrecorded	10	800
Sand, (Salt)	75	875
Unrecorded	5	880
Sand	20	900
Coal, (Sharon?)	6	906
Lime	32	938
Sand, (Maxton)	92	1030
Unrecorded	25	1055

	Thickness. Feet.	Total. Feet.
Red rock	45	1100
Unrecorded	170	1270
Little lime	25	1295
Pencil cave	11	1306
Big Lime	79	1385
Big Injun sand	122	1507
Unrecorded	133	1640
Sand, (Squaw)	20	1660
Unrecorded	56	1716
Sand, Gantz? (Berea) (gas, 1719′) to bottom	14	1730

The well starts about 160 feet below the Pittsburgh coal.

W. G. Kennedy No. 1 Well Record (718).

Located in Grant District, 0.9 mile southwest of Lost Creek. Authority, Tri-State Gas Company.

(Elevation, 1185′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	500	500
Sand, Dunkard? (Burning Springs)	90	590
Unrecorded	160	750
Sand, Salt (II Cow Run and Salt) (water, 810′)	205	955
Unrecorded	190	1145
Maxton sand	25	1170
Unrecorded	174	1344
Big Lime (water, 1384′)	78	1422
Big Injun sand	103	1525
Unrecorded	248	1773
Sand, Gantz? (Berea)	69	1842
Unrecorded	18	1860
Sand, (Gantz)	40	1900
Unrecorded	73	1973
Fifty-foot sand (water, 1975′ and 1978′)	17	1990
Unrecorded	70	2060
Sand, (Thirty-foot)	52	2112
Unrecorded	23	2135
Sand, (Gordon Stray)	30	2165
Unrecorded	8	2173
Sand, Gordon Stray? (Gordon)	13	2186
Unrecorded	9	2195
Sand, Gordon? 10′ } (Fourth)	45	2240
Unrecorded 25 }		
Sand, Fourth 10 }		
Unrecorded	64	2304
Fifth sand (gas, 2304′ and 2311′) to bottom	21	2325

Reamed, 133′; cased at 1845′; pulled, reamed and cased, 1998′. Tubed with 2325′ of 3″ and one 5$\frac{3}{16}$″x3″ Larkin packer.

The well starts 125 feet below the Pittsburgh coal.

S. J. Davisson No. 1 Well Record (718A).

Located in Grant District, ¾ mile southwest of Lost Creek. Authority, Tri-State Gas Company.

(Elevation, 1330′ B-A. T.)

	Thickness. Feet.	Total. Feet.
Unrecorded	10	10
Pittsburgh coal? (Redstone)	5	15
Unrecorded	545	560
Big Dunkard sand	40	600
Unrecorded	265	865
Salt sand	325	1190
Unrecorded	310	1500
Little Lime	20	1520
Unrecorded	10	1530
Big Lime	65	1595
Big Injun sand	80	1675
Unrecorded	223	1898
Sand, Gantz (Berea) (gas, 1919′; water, 1940′)	80	1978
Unrecorded	62	2040
Fifty-foot sand	60	2100
Unrecorded	210	2310
Sand, Gordon Stray? (Gordon)	14	2324
Unrecorded	9	2333
Sand, Gordon? 17′		
Unrecorded 25 } **(Fourth)**	57	2390
Sand, Fourth 15		
Unrecorded	60	2450
Fifth sand (gas, 2456′-2463′)	18	2468
Unrecorded to bottom	26	2494

"Cased at 1919′; afterward reamed down and cased at 1986′."

L. B. Davisson No. 1 Well Record (732C).

Located in Grant District, 1¼ miles southwest of Lost Creek. Authority, Tri-State Gas Company.

	Thickness. Feet.	Total. Feet.
Unrecorded	90	90
Coal, (Elk Lick)	3	93
Unrecorded	62	155
Coal, (Harlem)	5	160
Unrecorded	340	500
Sand, Dunkard ("Gas")	60	560
Unrecorded	135	695
Sand, Salt (Il Cow Run and Salt)	415	1110
Unrecorded	226	1336
Big Lime	59	1395
Big Injun sand	142	1537
Unrecorded	203	1740
Sand, Gantz? (Berea)	36	1776
Unrecorded	54	1830
Sand, (Gantz)	15	1845
Unrecorded	255	2100
Sand, Gordon Stray (Gordon)	15	2115

	Thickness. Feet.	Total. Feet.
Unrecorded	35	2140
Sand, Gordon? (Fourth)	20	2160
Unrecorded	20	2180
Fourth sand	15	2195
Unrecorded	67	2262
Fifth sand (gas, 2265′)	16	2278
Slate and shells (bridged at 2310′ and shot)	342	2620
Lime	20	2640
Unrecorded	65	2705
Sand	10	2715
Unrecorded	138	2853
Sand	32	2885
Unrecorded	15	2900
Lime	15	2915
Unrecorded	85	3000
Lime	25	3025
Unrecorded	50	3075
Lime	75	3150
Unrecorded to bottom	33	3183

The above is a very interesting record, in that two sands are reported several hundred feet below the Fifth sand, the well reaching a depth of over 3400 feet below the Pittsburgh coal bed.

The detailed record of the C. S. Gribble No. 1 well (708A), located one mile southeast from Lost Creek, is published in connection with the section for the latter place, page 124. This well is a heavy gasser in the Berea, Fourth and Fifth sands, having an initial daily volume of 5,500,000 cubic feet from all sands.

A brief record of the L. D. Blake No. 1 well (712), located near the head of Lost creek in the southeast corner of Grant, is given in the Harrison county table of wells.

About 15 gas wells have been drilled along the southern border of Grant, in the region immediately surrounding McWhorter. The following is the record of one of these wells, taken from page 670 of Vol. II(A) of the State Survey reports:

W. H. NcWhorter No. 3 Well Record (725).

Loated in Grant District, 2¼ miles southwest of Lost Creek. Authority, The Raven Carbon Company.

(Elevation, 1390′ B-A. T.)	Thickness Feet.	Total Feet.
Unrecorded	8	8
Redstone coal and unrecorded	42	50

	Thickness. Feet.	Total. Feet.
Pittsburgh coal and unrecorded	405	455
Coal, (Bakerstown)	6	461
Unrecorded	89	550
Sand, Little Dunkard? Big Dunkard)	70	620
Unrecorded	205	825
Sand, (II cow Run and Salt)	315	1140
Unrecorded	10	1150
Sand, (Salt)	45	1195
Unrecorded	20	1215
Sand, (Salt)	81	1296
Unrecorded	258	1554
Big Lime	61	1615
Big Injun sand	145	1760
Unrecorded	191	1951
Sand, Gantz? (Berea) (gas, 1957′)	61	2002
Unrecorded	331	2333
Gordon Stray	12	2345
Unrecorded	7	2352
Gordon sand (gas, 2358′; water, 2361′) and unrecorded to bottom	10	2362

"Initial daily volume of gas 1,500,000 cu. ft. from the Gantz? (Berea) and 1,000,000 cu. ft. from the Gordon.

The following is the record of a gas well drilled on Lost creek, near the axis of the Shinnston Basin. The well starts about 135 feet below the Pittsburgh coal:

Porter Maxwell No. 1982 Well Record (720).

Located in Grant District, 1¾ miles southeast of West Milford. Authority, Philadelphia Company. Completed Oct. 5, 1909.

(Elevation, 1015′ B-A. T.)	Thickness Feet.	Total Feet.
Unrecorded	370	370
Sand, Little Dunkard? (Big Dunkard)	48	418
Unrecorded	27	445
Sand, Big Dunkard? (Burning Springs and "Gas") (water, 555′)	145	590
Unrecorded	75	665
Sand, "Gas"? (II Cow Run)	55	720
Unrecorded	90	810
Salt sand	40	850
Unrecorded	475	1325
Big Lime	80	1405
Big Injun sand	205	1610
Unrecorded	140	1750
Sand, Gantz? (Berea)	40	1790
Unrecorded	50	1840
Fifty-foot sand (water, 1860′)	45	1885
Unrecorded	35	1920
Thirty-foot sand	43	1963
Unrecorded	77	2040

	Thickness. Feet.	Total. Feet.
Sand, Gordon Stray? (Gordon)	55	2095
Unrecorded	38	2133
Sand, Gordon? (Fourth) (oil, 2133'; water, 2136')	62	2195
Unrecorded	71	2266
Fifth sand, (gas, 2270')	18	2284
Unrecorded to bottom	168	2452

10" casing, 178'; 8¼" casing, 671'; 6⅝ casing, 1570'; 5$\frac{3}{16}$" casing, 2166'.

Pressure test in 5$\frac{3}{16}$" pipe:

	Before Shot	After Shot
1st minute	0 lbs.	15 lbs.
2nd minute	2 lbs.	30 lbs.
5th minute	13 lbs.	55 lbs.
10th minute	30 lbs.	65 lbs.
15th minute	40 lbs.	130 lbs.
20th minute	50 lbs.	... lbs.

The following is the record of a well 1.5 miles almost due eastward:

Porter Maxwell No. 2039 Well Record (721).

Located in Grant District, 1¼ miles north of Lost Creek. Authority, Philadelphia Company. Completed Sept. 15, 1910.

(Elevation, 1245' B-A. T.)	Thickness Feet.	Total Feet.
Conductor (**Pittsburgh coal** at about 15')	17	17
Unrecorded	233	250
Sand, Little Dunkard? (Murphy)	50	300
Unrecorded	125	425
Sand, Big Dunkard? (I Cow Run)	25	450
Unrecorded	104	554
Sand, "Gas"? (Big Dunkard)	19	573
Unrecorded	162	735
Sand, First Salt? (Clarion)	30	765
Unrecorded	100	865
Salt sand	179	1044
Unrecorded	166	1210
Sand, Maxton? (Salt)	40	1250
Unrecorded	235	1485
Pencil cave	15	1500
Big Lime	60	1560
Big Injun sand	120	1680
Unrecorded	30	1710
Squaw sand	50	1760
Unrecorded	80	1840
Berea sand	20	1860
Unrecorded	64	1924
Gantz sand	6	1930
Unrecorded	10	1940
Fifty-foot sand (gas and water, 1940')	34	1974
Unrecorded	36	2010

	Thickness. Feet.	Total. Feet.
Thirty-foot sand	25	2135
Unrecorded	100	2235
Gordon Stray sand	20	2255
Unrecorded	20	2275
Gordon sand	32	2307
Unrecorded	135	2442
Fifth sand (gas, 2446')	33	2475
Shells to bottom	20	2495

13" casing, 16'; 10" casing, 239'; 8¼" casing, 1207'; 6⅝" casing, 1585'; 3" tubing, 2492'.

Southeastward on Duck creek, near the axis of the Shinnston Basin the Southern Oil Company drilled the Enoch Gaston No. 1 well (722), the log of which was published on page 334 of Vol. I(A) of the State Survey reports. A little gas and a show of oil was encountered in what appears to be the Fifth sand in this well, and not the Bayard as given in the report mentioned, as the top of the latter sand belongs 1000 feet below the top of the Big Injun sand in the Clarksburg region a short distance northeastward.

One mile farther down Duck creek there occurs a small oil pool in what appears to be the Thirty-foot sand, represented by the A. A. Smith No. 1 (730), and H. Burnside & Smith No. 1 (731) wells. According to a brief record of the latter well, as furnished by the South Penn Oil Company (the owners) the producing sand is the Gordon, coming only 635 feet below the top of the Big Injun sand. The following record of a well, 1.3 miles northeastward, shows the top of the Gordon coming 727 feet below the top of the Big Injun: hence, the oil evidently belongs in the Thirty-foot. The first well (730) is reported as having an initial production of 5 barrels daily; and the second (731), 20 barrels daily:

Mary F. Price No. 1 Well Record (732).

Located in Grant District, 0.3 mile south of West Milford. Authority, Vesper Gas Company.

(Elevation, 1130' L-A. T.)	Thickness Feet.	Total Feet.
Conductor	13	13
Unrecorded (water, 60')	77	90
Sand, (Murphy)	25	115
Slate	65	180

	Thickness. Feet.	Tota' Feet.
Sand, (Grafton)	30	210
Slate and shells	285	495
Sand, (Big Dunkard)	55	550
Slate and shells	300	850
Sand, (Salt)	50	900
Slate	45	945
Sand, (Salt)	155	1100
Slate and shells	100	1200
Red rock	140	1340
Slate and shells	40	1380
Big Lime	60	1440
Big Injun sand (little gas, 1456'; little gas, 1631'; steel line measurement)	115	1555
Slate and shells	270	1825
Sand, Gantz? (Berea) (gas, 750,000 cu. ft., 1828'; steel line measurement)	25	1850
Slate	35	1885
Slate and shells	55	1940
Fifty-foot sand	25	1965
Slate	30	1995
Thirty-foot sand (small gas, 1996')	10	2005
Slate	60	2065
Red rock	102	2167
Sand, Stray? (Gordon)	30	2197
Slate	20	2217
Sand, Gordon? (Fourth)	20	2237
Slate	88	2325
Fifth sand (small gas, 2325' and 2335')	18	2343
Unrecorded to bottom	4	2347

The well starts 87 feet by hand-level below the Pittsburgh coal.

The record shows the Berea to be the main gas horizon.

Southward from Goodhope in Grant district, there occur several gas wells along and near the crest of the Wolf Summit anticline. The following is a record of one of these wells that starts 40 feet by aneroid above the base of the Ames limestone:

Mary J. Burnside No. 1 Well Record (728).

Located in Grant District, 0.9 mile south of Goodhope. Authority, Wheeling Natural Gas Company.

(Elevation, 1025' B-A. T.)	Thickness Feet.	Total Feet.
Unrecorded (water at 40')	240	240
Big Dunkard sand	50	290
Unrecorded	66	356
Sand ("Gas")	44	400
Unrecorded	95	495
Sand (water, 526') (Clarion)	25	520

	Thickness. Feet.	Total. Feet.
Coal, (Clarion)	4	524
Sand, Big Dunkard? (II Cow Run)	41	565
Unrecorded	35	600
Sand, "Gas"? (Salt)	40	640
Unrecorded	25	665
Salt sand	150	815
Unrecorded	5	820
Salt sand	80	900
Unrecorded	30	930
Salt sand	40	970
Unrecorded	105	1075
Maxton sand (gas, 1080')	35	1110
Unrecorded	15	1125
Little lime	35	1160
Pencil cave	10	1170
Big Lime	50	1220
Big Injun sand	170	1390
Unrecorded	250	1640
Sand, Gantz? (Berea)	24	1664
Unrecorded	36	1700
Sand, Fifty-foot? (Gantz)	20	1720
Unrecorded	30	1750
Sand, Thirty-foot? (Fifty-foot) gas, 1755')	21	1771
Unrecorded	89	1860
Gordon Stray sand	40	1900
Unrecorded	27	1927
Gordon sand (gas, 1934')	35	1962
Unrecorded	101	2063
Fifth sand (gas, 2065' and 2073')	15	2078
Unrecorded to bottom	2	2080

Prospective Oil and Gas Territory, Grant District.—There yet remains a large acreage of untested territory in Grant district that is favored both by present development and geologic structure. Considering these areas from west to east, (1) that portion of the district between the axes of the Wolf Summit anticline and the Shinnston syncline, southwestward from Duck creek to the Harrison-Lewis county line appears good for gas in the Berea, Thirty-foot and Fifth sands; (2) that, immediately northwestward from the wells (730 and 731) on Duck creek, for Thirty-foot sand oil, with a chance for gas in the Big Injun, Berea, and Fifth; (3) that, southeastward from West Milford between the channels of Lost and Duck Creeks, for gas at the same horizons; (4) that, northeastward from Lost creek to Browns creek and westward from the 1225-foot contour of the Pittsburgh coal as outlined on the structure map accompanying this report, for gas; (5) and that, southward from Rockford to the Harrison-Lewis county line, for gas in the Fifty-foot, Berea, Fourth and Fifth sands.

ELK DISTRICT.

Elk district occupies the southeastern corner of Harrison county, and its area is traversed by three structural folds; viz., the Chestnut Ridge and Ruraldale anticlines, and the Grassland syncline. Only 7 or 8 wells have ever been drilled within its boundaries, 6 of which were gassers, and the others comparatively dry holes. The two following records are from gas wells located in this district along the western slope of the Chestnut Ridge Arch:

Frank White No. 1 Well Record (733).

Located in Elk District, 1 mile northwest of Quiet Dell. Authority, Hope Natural Gas Company.

(Elevation, 1090′ B-A. T.)	Thickness Feet.	Total Feet.
Unrecorded	1400	1400
Big Injun sand	100	1500
Unrecorded (gas in **Thirty-foot sand**)	803	2303
Fifth sand (gas)	28	2331
Unrecorded to bottom	4	2335

The well starts about 160 feet below the Pittsburgh coal.

H. Booth (Carr) No. 1 Well Record (734).

Located in Elk District, on Suds run, 1.3 miles southward from Quiet Dell. Completed in 1888.

(Elevation, 1010′ L-A. T.)	Thickness. Feet.	Total Feet.
Conductor	4	4
Sand	3	7
Fireclay	10	17
Slate, black	40	57
Flint (Hughes River) (Brush Creek Limestone)	5	62
Shale, red	12	74
Limestone, hard	32	106
Sand, gray	14	120
Sand, black	5	125
Shale, sandy	10	135

	Thickness. Feet.	Total Feet.
Sand, hard, black 5'		
Sandstone, brown 18'		
Sandstone, hard, white 4'		
Limestone 9'		
Sandstone, hard, white 14'		
Sandstone, brown, hard 9'		
Sandstone, hard, white 23'		
(Big Dunkard)	82	217
Slate, black	33	250
White slate and shells	25	275
Limestone and sand	8	283
Soapstone	7	290
Gas sand		
Sandstone, gray	33	323
Shale, sandy	35	358
Sand, black	4	362
Slate, white	21	383
Black, flint	4	387
Sand, white	6	393
Coal, (Lower Kittanning)	1	394
Shale, black	31	425
Slate, black	15	440
Slate, white	27	467
Sand, white (II Cow Run) (salt water) (gas from 467 to 472 feet—odorless)	35	502
Sand, black	16	518
Sand, white (salt water)	32	550
Slate, brown	13	563
Slate or shale, black	37	600
Sand, white (salt water) (Salt)	70	670
Sand, black	8	678
Sand, white	2	680
Shale, black	22	702
Limestone	8	710
Sand, gray	35	745
Slate, light colored	5	750
Sand, gray	37	787
Black slate and shale	113	900
Sand, gray	20	920
Limestone, dark	20	940
Slate, red	5	945
Slate, black	5	950
Slate, red	86	1036
Slate, white	34	1070
Sand, gray	20	1090
Slate, white	20	1110
Shale, sandy	30	1140
Slate, white	10	1150
Shale, black	20	1170
Shale, white	25	1195
Slate, red	5	1200
Slate, black	5	1205
Limestone (gas) (Big Lime)	70	1275
Sand, gray (Big Injun, top ledge)	7	1282
Sand, dark	7	1289
Limestone	11	1300
Sand, white	15	1315

	Thickness. Feet.	Total Feet.
Shale, red	5	1320
Sand, gray	15	1335
Limestone and sand	15	1350
Sand, gray	15	1365
Gray shelly sand (trace of oil) (Big Injun, lower ledge)	7	1372
Shale, red	12	1384
Slate, blue	91	1475
Hard shelly slate	10	1485
Sand, gray	5	1490
Sand and shells	30	1520
Shale, light	90	1610
Gray sandy shells	15	1625
Shale, light	50	1675
Slate, white	45	1720
Sand, gray 34' Sand, dark, shelly 13' Sand, gray 17' Sand, dark gray 26' Sand, light shelly 25' Sand, fine white 15' (Gantz and Ffity-foot)	130.	1850
Sand, light shelly	20	1870
Slate, dark	5	1875
Sand, gray (Thirty-foot) (trace of oil)	10	1885
Sand, black	5	1890
Slate, blue	5	1895
Sand, (Gordon Stray) Sand, gray 27' Sand, light gray (gas) 4' Sand, gray, shelly 9'	40	1935
Slate, blue	7	1942
Slate, red	8	1950
Sand, red	45	1995
Slate, dark	20	2015
Sand, gray (Gordon) (trace of oil and gas)	15	2030
Slate, dark	15	2045
Sand, gray	15	2060
Shale, blue, sandy	40	2100
Sand, blue, (Fourth)	20	2120
Slate, dark, hard and shelly	10	2130
Sand, gray (oil) (Fifth)	20	2150
Slate and shells	85	2235
Sand, dark, pebbly (gas) 8' Slate, white 4 Sand, brown, to bottom 10 (Bayard)	22	2257

The well starts nearly flush with the horizon of the Bakerstown coal.

The above record is very interesting in that complete details are given of all formations penetrated. Only one thin coal (Lower Kittanning) is reported. A trace of oil was encountered in the Big Injun, Thirty-foot, Gordon and Fifth sands; and gas in the II Cow Run, Big Lime, Gordon Stray, and Bayard sands.

The following is the record of a well on Hastings run, nearly on the axis of the Chestnut Ridge anticline, that starts 20 feet by hand-level below the Harlem coal, or 350 feet below the Pittsburgh bed:

Arthur Conley No. 1 Well Record (736).

Located in Elk District, 2¼ miles west of Romines Mills. Authority, Hope Natural Gas Company.

(Elevation, 1155′ L-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1225	1225
Big Injun sand	90	1315
Unrecorded	764	2079
Fifth sand (gas)	36	2115
Unrecorded to bottom	243	2358

One mile and a half northeastward the Tri-State Gas Company drilled a light gasser (737) on the A. H. Davisson farm, the detailed record of which is published in connection with the Romines Mills section, page 126.

Two comparatively dry holes (738 and 739) were drilled on Rooting creek along the extreme southern border of Elk district, near the axis of the Grassland Basin. The following is a record of one of these wells:

E. W. Post No. 1 Well Record (738).

Located in Elk District, ½ mile south of Johnstown. Authority, J. M. Guffey.

(Elevation, 1060′ B-A. T.)	Thickness. Feet.	Total. Feet.
Unrecorded	1390	1390
Big Lime	75	1465
Unrecorded	10	1475
Big Injun sand	85	1560
Unrecorded to bottom	921	2481

The well starts 230 feet by aneroid below the Pittsburgh coal.

The following is the record of a well drilled by the Hope Natural Gas Company a short distance (2.3 miles) across the Harrison county line in northern Upshur. The well starts 210 feet by aneroid below the Pittsburgh coal. The well would have made about 5 barrels daily from what appears to be the Squaw sand:

Isaac Reger No. 1 Well Record (740).

Located in Warren District, Upshur county, on Hacker's Creek. 2½ miles west of Rural Dale. Authority, N. D. Goe, Contractor.

(Elevation, 1075' B-A. T.)		Thickness. Feet.	Total. Feet.
Conductor		14	14
Unrecorded (water at 80')		169	183
Coal, (Bakerstown)		2	185
Unrecorded		40	225
I Cow Run	Sand (I Cow Run)	20	245
	Unrecorded	10	255
	Sand (water)	45	300
Unrecorded		85	385
Coal, (Upper Freeport)		2	387
Unrecorded		13	400
Sand, (Burning Springs)		10	410
Unrecorded		120	530
Sand		20	550
Unrecorded		60	610
Coal, (Clarion)		5	615
Unrecorded		37	652
Coal, (Tionesta?)		6	658
Unrecorded		35	693
Coal, (Upper Mercer?)		4	697
Unrecorded		83	780
Sand (Salt) (water)		35	815
Unrecorded		49	864
Sand (Salt) (water)		76	940
Unrecorded		100	1040
Sand (Salt)		60	1100
Unrecorded		5	1105
Sand (oil, 1146') (Salt)		62	1167
Red rock		246	1413
Unrecorded		18	1431
Little lime		22	1453
Pencil cave		24	1477
Big Lime		77	1554
Big Injun sand		143	1697
Unrecorded		89	1786
Sand, Gantz?	**(Squaw)**	14	1800
Unrecorded		8	1808
Sand (oil and water, 1834', 5 barrels)		48	1856
Unrecorded		6	1862
Sand		10	1872
Unrecorded		143	2015
Red rock at			2015
Unrecorded		160	2175
Sand, Stray (Gordon Stray)		35	2210
Unrecorded		10	2220
Sand, Gordon		25	2245
Unrecorded		46	2291
Sand, Fourth		12	2303
Unrecorded		309½	2612½

10" casing, 310'; 8" casing, 850' and 6½" casing, 2121'.

A dry hole was drilled during 1911 and about 2 miles farther down Hackers creek near the Upshur-Lewis county line, on the Foster (741) farm.

Prospective Oil and Gas Territory, Elk District.—As mentioned on a preceding page, very little drilling for oil and gas has yet been done in Elk district. There is, however, a large acreage within its boundaries that warrants the drilling of more wells, especially for gas. Considering these areas from northwest to southeast across the district, (1) that portion of Elk westward to the district line from the 1375-foot contour of the Pittsburgh coal as outlined on the structure map accompanying this report, appears good for gas in the Fifty-foot, Thirty-foot and Fifth sands; (2) that, southwestward from Brushy fork of Elk along the crest of the the Chestnut Ridge anticline, for gas in the Berea, Fifty-foot, Fourth, Fifth and Bayard; and (3) that, along and near the axis of the Grassland syncline may possibly hold an oil pool in one of the sands below the Big Injun. The last record above given is only a short distance east of the axis of this Basin; hence, this Squaw sand oil pool may extend northeastward into Elk district, along the eastern slope of this syncline.

CHAPTER IX.

COAL

A discussion has already been given of the geology, structure and character of the coal beds of Doddridge and Harrison counties on preceding pages of this report. The purpose of this chapter is to give a more detailed discussion of the chemical composition and character of the apparent commercial coals, as well as their probable available area in the two counties.

STATISTICS OF COAL PRODUCTION.

In the Doddridge-Harrison area, coal mining on a commercial scale has been confined entirely to the Redstone and Pittsburgh beds. As mentioned on preceding pages of this report, both coals lie deeply buried in Doddridge and in western Harrison, but in the central and eastern portions of the latter county, the Wolf Summit and Chestnut Ridge anticlines have elevated both beds above drainage, so that they are easily accessible to drift openings. Hence, all the development thus far in the area under discussion has been confined to Harrison county.

The three following tables have been compiled from the annual report for the year ending June 30, 1910, of John Laing, Chief of the Department of Mines of West Virginia:

Coal Production of Harrison County from 1888 to 1910 inclusive.

Year	Tons of 2240 lbs.	Year	Tons of 2240 lbs.
1888	113,030	1901	1,088,715
1889	111,440	1902	1,662,144
1890	128,964	1903	2,108,336
1891	113,268	1904	2,445,202
1892	142,960	1905	2,560,905
1893	248,099	1906	3,030,737
1894	275,297	1907	3,343,319
1895	204,442	1908	3,168,042
1896	155,772	1909	3,005,689
1897	221,249	1910	3,708,123
1898	271,554		
1899	413,150	Total	29,167,867
1900	647,430		

Order of the Counties in the Production of Coal, 1897-1910.

Counties	1897	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910
Fayette	1	1	1	1	1	1	2	1	2	2	2	2	2	2
McDowell	2	2	2	2	2	2	1	2	1	1	1	1	1	1
Marion	3	3	3	3	3	3	3	4	3	4	4	4	4	4
Kanawha	4	4	4	4	4	4	5	3	4	3	3	3	3	3
Mercer	5	5	5	6	6	6	6	6	6	6	6	6	6	7
Harrison	**9**	**9**	**8**	**7**	**5**	**5**	**4**	**5**	**5**	**5**	**5**	**5**	**5**	**5**
Tucker	6	6	7	5	7	7	7	8	8	8	10	10	10	10
Mingo	8	8	9	9	9	8	8	7	7	7	7	7	9	9
Mineral	7	7	6	8	8	9	11	11	12	13	14	13	11	13
Preston	13	11	10	10	10	10	9	10	10	9	9	11	13	11
Taylor	10	10	11	11	11	11	14	16	16	16	17	17	16	15
Marshall	11	12	12	12	13	16	13	14	14	15	15	18	19	16
Randolph	..	..	..	14	14	14	12	13	13	12	13	14	14	14
Barbour	19	19	17	18	12	12	10	9	11	11	11	12	12	12
Raleigh	16	16	16	19	17	13	15	12	9	10	8	8	8	6
Putnam	12	13	13	13	15	15	16	15	15	14	18	16	17	17
Ohio	15	15	14	15	16	17	18	19	21	22	21	21	21	20
Brooke	17	18	18	20	20	20	23	22	17	17	16	15	15	18
Mason	14	14	15	16	18	19	19	20	22	21	22	22	22	22
Grant	..	..	..	..	..	..	22	18	19	19	20	20	20	21
Logan	..	..	..	..	..	..	..	..	20	18	12	9	7	8
Monongalia	20	17	19	17	19	18	17	17	18	20	19	19	18	19
Hancock	18	20	20	21	21	21	20	21	24	24	23	25	26	24
Clay	..	..	..	..	..	..	..	25	23	23	24	27	30	30
Nicholas	..	..	..	..	..	22	24	24	25	25	25	26	27	26
Lincoln	..	..	..	..	..	23	21	23	27	26	30	30	25	28
Braxton	..	..	..	..	..	..	..	..	..	..	26	23	23	23
Wayne	..	..	..	..	..	..	..	..	26	27	29	29	28	29
Upshur	..	..	..	..	..	..	..	..	..	28	27	24	24	25
Greenbrier	..	..	..	..	..	..	..	..	..	..	28	28	29	32
Lewis	..	..	..	..	..	..	..	..	..	..	31	31	32	33
Gilmer	..	..	..	..	..	..	..	..	..	..	32	32	31	31
Wyoming	..	..	..	..	..	..	..	..	..	..	..	33	34	34
Boone	..	..	..	..	..	..	..	..	..	..	..	..	33	27

Production of Coal and Coke in Harrison County for the Year Ending June 30, 1910.

COMPANY	MINE	PRODUCTION OF COAL (Tons of 2240 lbs.)			DISTRIBUTION OF COAL (Tons of 2240 lbs.)				PRODUCTION OF COKE (Tons of 2000 lbs.)		
		First 6 Months	Second 6 Months	Total for Year	Used in Operation of Mine	Furnished Local Trade and Tenants	Used in Coke Ovens	Shipped from Mine	First 6 Months	Second 6 Months	Total for Year
Consolidation Coal Co.	No. 21	59,996	74,000	133,996	5,550	961	1,038	126,447	......	675	675
Consolidation Coal Co.	No. 23	24,726	29,015	53,741	......	20	......	53,721	......	......	......
Consolidation Coal Co.	No. 25	118,318	121,308	239,626	2,293	1,200	......	236,133	......	......	......
Consolidation Coal Co.	No. 27	29,221	34,395	63,616	......	120	......	63,496	......	......	......
Consolidation Coal Co.	No. 29	52,393	58,025	110,418	2,070	355	......	107,993	......	......	......
Consolidation Coal Co.	No. 31	2,863	2,207	5,070	......	66	......	5,004	......	......	......
Consolidation Coal Co.	Nos. 1 & 2 No. 32	739	50,606	51,345	500	107	......	50,738	......	......	......
Consolidation Coal Co.	No. 33	19,438	19,866	39.304	......	165	......	39,139	......	......	......
Consolidation Coal Co.	Nos. 1, 2, 3 4, No. 35	48,643	61,055	109,698	1,440	253	......	108,005	......	......	......
Consolidation Coal Co.	No. 39	31,857	36,210	68,067	1,735	459	......	65,873	......	......	......
Consolidation Coal Co.	No. 40	43,110	62,666	105,776	......	249	......	105,527	......	......	......
Consolidation Coal Co.	Glen Falls	124	114	238	......	238	......	....	......	......	......
Consolidation Coal Co.	No. 42	18,987	24,710	43,697	116	151	......	43,430	......	......	......
Consolidation Coal Co.	No. 44	250	2,307	2,557	......	......	......	2,557	......	......	......
Consolidation Coal Co.	No. 46	3,298	4,435	7,733	......	40	......	7,693	......	......	......
Consolidation Coal Co.	No. 48	20,570	30,771	51,341	......	177	......	51,164	......	......	......
Consolidation Coal Co.	No. 49	99,701	123,250	222,951	5,004	1,004	36	216,907	23	......	23
Consolidation Coal Co.	Nos. 1 & 2 No. 50	61,670	74,555	136,225	......	4	......	136,221	......	......	......
Consolidation Coal Co.	Nos. 1 & 3 No. 51	43,750	57,471	101,221	900	647	......	99,674	......	......	......
Consolidation Coal Co.	No. 52	34,651	54,660	89,311	1,721	207	......	87,383	......	......	......
Consolidation Coal Co.	No. 54	24,503	30,119	54,622	1,021	146	......	53,455	......	......	......
Consolidation Coal Co.	Nos. 1 & 2, No. 55	38,669	41,958	80,627	906	527	......	79,104	......	......	......

Production of Coal and Coke in Harrison County for the Year Ending June 30, 1910.—Continued.

COMPANY	MINE	PRODUCTION OF COAL (Tons of 2240 lbs.)			DISTRIBUTION OF COAL (Tons of 2240 lbs.)				PRODUCTION OF COKE (Tons of 2000 lbs.)		
		First 6 Months	Second 6 Months	Total for Year	Used in Operation of Mine	Furnished Local Trade and Tenants	Used in Coke Ovens	Shipped from Mine	First 6 Months	Second 6 Months	Total for Year
Consolidation Coal Co.	No. 58	13,173	21,484	34,657	504	......	......	34,153	......	......	......
Consolidation Coal Co.	No. 60	4,206	8,929	13,135	11	37	......	13,087	......	......	......
Consolidation Coal Co.	No. 62	19,776	30,904	50,680	......	......	......	50,680	......	......	......
Consolidation Coal Co.	No. 64	27,826	29,931	57,757	1,200	311	......	56,246	......	......	......
Consolidation Coal Co.	No. 65	25,037	29,926	54,963	1,500	35	......	53,428	......	......	......
Consolidation Coal Co.	No. 66	38,726	49,862	88,588	1,508	146	......	86,934	......	......	......
Virginia-Md. Coal Corp.	Willard Nos. 1 & 2	55,745	57,246	112,991	......	327	......	112,664	......	......	......
Cook Coal & Coke Co.	Girard Nos. 1 & 2	49,021	48,810	97,831	1,038	413	......	96,380	......	......	......
Corona Coal & Coke Co.	Harold	33,536	41,099	74,635	......	159	......	74,476	......	......	......
Central Fairmont Coal Co.	Snake Hill	24,375	26,568	50,943	......	......	......	50,943	......	......	......
Vincent Coal Co.	Graselli	29,139	28,181	57,320	......	27	......	57,293	......	......	......
Haywood Coal Mining Co.	Monroe	19,544	5,732	25,276	25	......	......	25,251	......	......	......
Hutchinson Coal Co.	Erie	77,194	74,425	151,619	361	1,367	......	149,891	......	......	......
Hutchinson Coal Co.	Delta	......	2,000	2,000	24	......	......	1,976	......	......	......
Hutchinson Coal Co.	Byron Nos. 1, 2 & 3	93,796	72,675	166,471	......	......	6,722	159,749	265	3,760	4,025
Harrison County Coal Co.	Overholt	8,000	12,500	20,500	......	......	......	20,500	......	......	......
Lambert Run Coal Co.	Clauson	8,910	21,565	30,475	......	......	......	30,475	......	......	......
Hero Coal & Coke Co.	Hero	9,924	16,800	26,724	......	......	......	26,724	......	......	......
Blue Ridge Coal Co.	Thompson	15,500	15,500	31,000	......	......	......	31,000	......	......	......
Rosebud Fuel Co.	Rosebud	15,246	20,096	35,342	212	200	......	34,930	......	......	......
Monroe Colliery Co.	Sylvester	18,496	12,331	30,827	......	......	......	30,827	......	......	......
Peacock Coal Co.	Sylvester	......	9,058	9,058	58	......	......	9,000	......	......	......
National Coal Co.	Dola	11,451	10,523	21,974	......	......	......	21,974	......	......	......

Production of Coal and Coke in Harrison County for the Year Ending June 30, 1910.—Continued.

COMPANY	MINE	PRODUCTION OF COAL (Tons of 2240 lbs.)			DISTRIBUTION OF COAL (Tons of 2240 lbs.)				PRODUCTION OF COKE (Tons of 2000 lbs.		
		First 6 Months	Second 6 Months	Total for Year	Used in Operation of Mine	Furnished Local Trade and Tenants	Used in Coke Ovens	Shipped from Mine	First 6 Months	Second 6 Months	Total for Year
Fayette Coal Co.	Fayette	8,164	14,246	22,410	480	105	......	21,825	......	......	......
Short Line Coal Co.	Girard Nos 2 & 3	30,532	22,102	52,634	1,051	10	......	51,573	......	......	......
Fairmont & Balto. C. & C. Co	Fairmore	14,427	36,760	51,187	......	100	......	51,087	......	......	......
Madeira-Hill-Clark Coal Co.	Goff	37,589	45,301	82,890	......	......	......	82,890	......	......	......
Madeira-Hill-Clark Coal Co.	Waldo	55,588	43,463	99,051	......	619	......	98,432	......	......	......
Madeira-Hill-Clark Coal Co.	Randolph & New Chieftain	55,423	54,889	110,312	......	311	......	110,001	......	......	......
Southern Coal & Trans. Co.	Miller Nos. 1 & 2	....	1,033	1,033	......	......	......	1,033	......	......	......
O'Gara Coal Mining Co.	O'Gara	21,501	29,026	50,527	......	......	......	50,527	......	......	......
W. B. Gunton Coal Co.	Phoenix	....	6,539	6.539	......	......	......	6,539	......	......	......
Pitcairn Coal Co.	Pitcairn	37,685	62,457	100,142	1,452	436	......	98,254	......	......	......
Marshall Coal Co.	Marshall	9,139	39,898	49,037	1,649	207	......	47,181	......	......	......
Cook & Hart Coal Co.	Cook	7,469	3,199	10,668	......	......	......	10,668	......	......	......
Clarksburg Gas Coal Co.	McWhorter	6,717	12,192	18,909	238	82	3,590	14,999	1,869	524	2,393
Marion Gas Coal Co.	Bingamon	5,842	13,974	19,816	108	165	......	19,543	......	......	......
Daniel Coal Co.	Gocke	....	3,475	8,475	......	......	......	3,475	......	......	......
Byron Coal Co.	Althea	1,200	7,000	8,200	40	......	......	8,160	......	......	......
Hygrade Coal Co.	Page	....	2,312	2,312	......	......	......	2,312	......	......	......
Kroger Gas Coal Co.	Polar	....	3,000	3,000	......	......	......	3,000	......	......	......
Lumberport Steam Coal Co.	Emory	....	35	35	......	10	......	25	......	......	......
		1,667,374	2,040,749	3,708,123	34,805	12,163	11,386	3,649,769	2,157	4,959	7,116

MINABLE COALS.

There are six workable coals in the two counties in addition to 16 other veins which are too thin and irregular to have any economic importance. The probable minable beds in descending order are the Washington, Uniontown, Redstone, Pittsburgh, Harlem and Upper Kittanning, all of which, except the last, crop in the area under discussion. As mentioned on a preceding page, only the Redstone and Pittsburgh seams have yet been mined on a commercial scale.

The chemical analyses and calorific results, given in this report were determined by J. Berghius Krak, Assistant Chemist of the Survey, under the direction of B. H. Hite, Chief Chemist. The same methods of analysis and sampling of the commercial mines were followed as by the Fuel Testing Department of the U. S. Geological Survey.

The calorific value of all coals is expressed in terms of British Thermal Units (B.T.U.). This unit of heat measurement represents the **amount of heat** required to raise **one pound** of water one degree Fahrenheit in temperature.

In any analysis, giving the B.T.U. result, the number of units represents the amount of heat stored up in **one pound** of coal. Along with the proximate and ultimate analysis is given the heat value, both determined by the calorimeter and calculated from the ultimate analysis, as well as the ratio of the total **carbon** to the **oxygen plus ash.** The latter ratio is the best yet devised for the classification of coals in order of their relative rank as to heat value.

The apparent commercial coals of the area will now be discussed in descending order.

COALS OF THE DUNKARD SERIES.

The Washington Coal

The Washington coal appears to be the only minable bed of the Dunkard series; that is, it is the only vein to attain sufficient thickness, purity and regularity to be figured as an asset in estimating the economic resources of the two counties. The crop of this coal is shown by an appropriate symbol

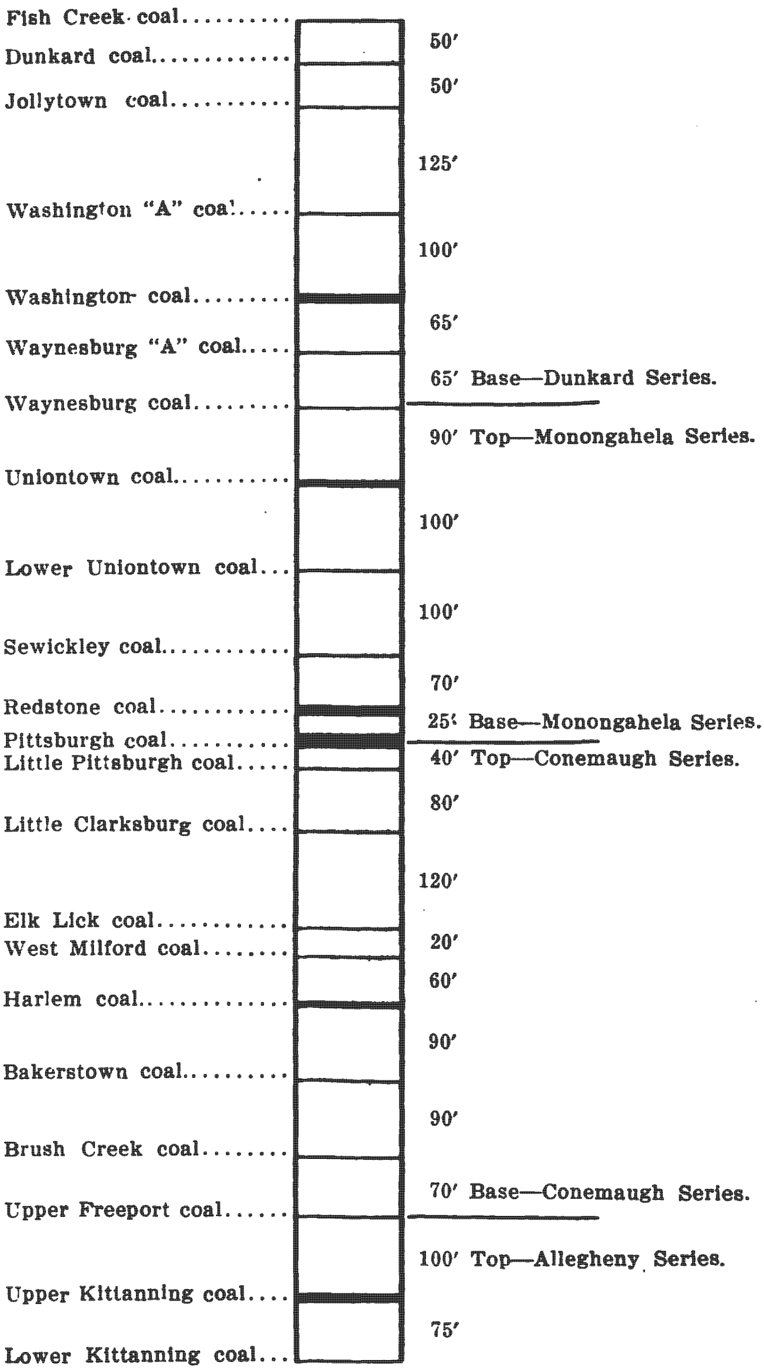


Fig. 3.—Diagram showing the relative position of all the coals in the Doddridge-Harrison area. The numerals represent intervals in feet between coals.

on the economic geology map accompanying this report. A detailed description of its thickness, character, distribution and chemical composition is given on pages 157-168. Therein are published four analyses of the bed, the average composition, calorific value and fuel ratio of which are given in the table of coal analyses on a subsequent page of this report.

Quantity of Washington Coal Available.

It is quite difficult even to approximate the available area and tonnage of Washington coal in the two counties, since, as already stated on preceding pages, the bed is often irregular and patchy in its nature, and is most generally concealed. The several sections given for the coal on the pages referred to above reveal its thickness where opened by farmers for domestic fuel; hence, the writer, in estimating the available tonnage, feels safe in assuming an average thickness of **18 inches** spread out over the areas given in the table below. A careful determination of its area left uneroded as shown on the map accompanying this report, has been made with a planimeter by Mr. Reger, the results of which are given in the table by magisterial districts.

Table Showing Approximate Available Washington Coal.

Counties by Districts	Sq. Miles	Acres	Cubic Feet of Coal	Short Tons of Coal
Doddridge				
McClellan	57.4	36,736	2,400,330,240	96,013,209
Grant	35.3	22,592	1,476,161,280	59,046,451
West Union	24.3	15,552	1,016,167,680	40,646,707
Central	25.0	16,000	1,045,440,000	41,817,600
Southwest	11.0	7,040	459,993,600	18,399,744
Cove	19.7	12,608	823,806,720	32,952,268
New Milton.......	36.3	23,232	1,517,978,880	60,719,155
Greenbrier	27.9	17,856	1,166,711,040	46,668,441
Totals	236.9	151,616	9,906,589,440	396,263,575

Counties by Districts	Sq. Miles	Acres	Cubic Feet of Coal	Short Tons of Coal
Harrison				
Sardis	31.2	19,968	1,304,709,120	52,188,364
Ten Mile	34.4	22,016	1,438,525,440	57,541,017
Union	6.0	3,840	250,905,600	10,036,224
Eagle	8.0	5,120	334,540,800	13,381,632
Clay	0.2	128	8,363,520	334,540
Totals	79.8	51,072	3,337,044,480	133,481,777
Total for both counties	316.7	202,688	13,243,633,920	529,745,352

In arriving at the above results, the writer assumed a weight of 80 pounds to the cubic foot of coal, or at the rate of 25 cubic feet to the 2000 pound ton. These figures agree with the determinations of the Fuel Testing Plant of the U. S. Geological Survey for the weight of the same amount of the Pittsburgh coal bed.

Owing to the great thickness, purity and availability of the Pittsburgh bed in the area under discussion, the Washington coal is, of course not now marketable. When the best coals become more expensive to mine and nearly exhausted, then these poorer grades of coal will no doubt be utilized for both heat and power.

COALS OF THE MONONGAHELA SERIES.

The Monongahela series in the Doddridge-Harrison area contains six coals; viz., Waynesburg, Uniontown, Lower Uniontown, Sewickley, Redstone and Pittsburgh. Their geology, distribution and thickness are discussed in detail in a preceding chapter of this report. Only the Uniontown, Redstone and Pittsburgh, however, appear to attain minable thickness in either county, and the two latter are the only beds to be mined on a commercial scale in the area under discussion.

The Uniontown Coal.

The Uniontown coal is the next bed of economic importance below the Washington seam. A full description of its structure, stratigraphy, and general distribution, along with two analyses of samples from openings by farmers, is given on pages 187-192 of this report. The results therein exhibited show a coal having about the same rank in its fuel rating as the Washington bed.

Quantity of Uniontown Coal Available.

In Harrison county the Uniontown coal appears too thin and irregular at all exposures observed to ever be mined, but in Doddridge county, where this bed crops along the Baltimore and Ohio Railroad between Long Run station and West Union, and 2 to 3 miles northward and southward therefrom, it attains a fair development, the bed often containing 2 to 3 feet of clean coal. In other portions of the county, where its horizon was observed, it appears too thin and irregular to ever be minable. Hence, in estimating the available tonnage of this coal, the writer feels safe in assuming an average thickness of **2 feet** spread out over 50 square miles in the region of its best development. Figuring on the basis of 25 cu. ft. to the short ton, the following results are obtained:

County.	Sq. Miles.	Acres.	Cubic Feet of Coal.	Short Tons of Coal.
Doddridge	50	32,000	2,787,840,000	111,513,600

The Redstone Coal.

The Redstone coal is the next bed of economic importance in descending order in the Monongahela series. A full description of its stratigraphy, thickness and distribution in the two counties, along with analyses and calorific tests of samples from local country banks, is given on pages 203-212 of this report. Therein it is shown to be a very high grade coal, having a slightly higher fuel ratio rating than the great Pittsburgh bed, 20 to 30 feet lower in the measures. The average results obtained from six samples of the coal are given in the table of analyses under Nos. 6-11 inclusive.

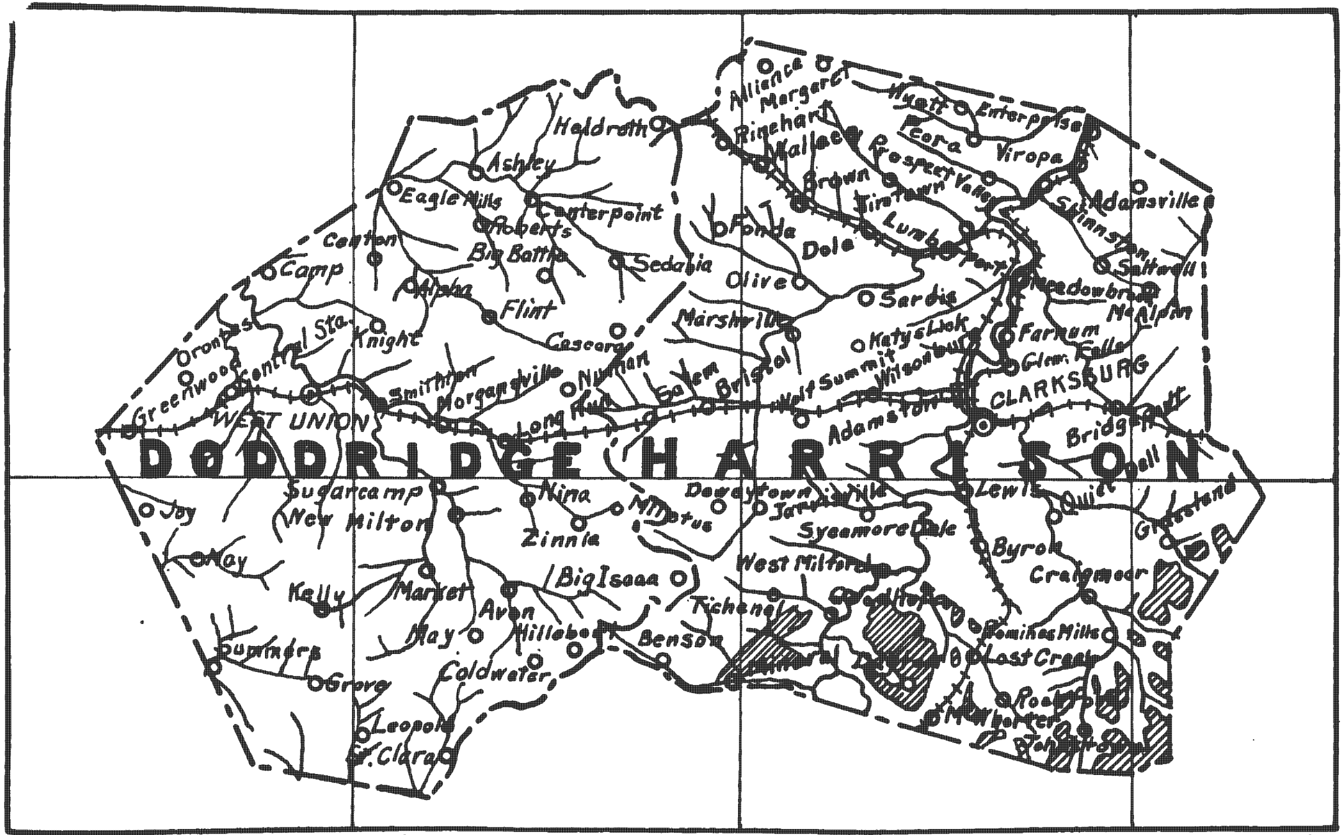


Fig. 4.—Line shading shows approximate area of available Redstone coal in both counties. (See Economic Geology Map.)

In addition to the data obtained from country banks, sections were measured and samples collected of the Redstone bed from three commercial mines, two of which are located in southern Harrison, and the other just across the county line in the edge of Lewis. One of these, the McWhorter mine, was formerly owned by the Jane Lew Coal & Coke Company, at which the writer obtained the following data which was published on pages 669-670 of Vol. II(A) of the State Survey reports, the mine being now owned by the Clarksburg Gas Coal Company:

Clarksburg Gas Coal Company—No. 9 on Map.

				Ft.	In.
1. Sandstone, massive and concealed, black slate at bottom				100	0
2. Bone				0	6
3. Coal, hard and bright	4′	0″	Redstone	6	1
4. Bone, 2″ to	0	1			
5. Coal, hard and bright	2	0			
6. Slate and shale				30	0
7. Coal, Pittsburgh, hard, 40″ to				4	0
8. Fire clay, gray.					

"In the section in formations Nos. 3, 4 and 5, clay seams 2 to 3 feet thick often come in from top to bottom of coal.

"Elevation of Redstone bed (aneroid), 1365′ A. T.; butts, S. 80° E.; faces, S. 10° W.; greatest rise to the southeast; mine capacity, 80 tons; number of men employed, 17; coal manufactured into coke on the premises, shipped west for smelting purposes; authority for mine data, John Harley, Supt.; samples for analysis from Nos. 3 and 5 of section, for which see under No. 9 in the table of coal analyses at the end of this chapter.

"Clay veins 2 to 3 feet across are frequent in the mine. The company has 20 beehive ovens in which it burns both 48 and 72 hour coke, which yielded the following results on analysis by Hite and Patton:

	Per cent
Moisture	0.20
Volatile Matter	0.50
Fixed Carbon	90.20
Ash	9.10
Total	100.00
Sulphur	1.19
Phosphorus	0.022

D. D. Teets, Jr., Field Assistant, obtained the following data at two mines in this coal in southern Harrison and northern Lewis:

High Grade Coal Co. (Page mine).—No. 10 on Map.

Location, ¼ mile N. E. of McWhorter; Redstone coal.

		Ft.	In.
1.	Slate		
2.	Coal	6	6½
3.	Slate		

"Tidal elevation, 1150', aneroid; principal office, Fairmont; daily capacity, 100 tons; 7 laborers and 12 miners employed; coal used for steam, gas and domestic fuel; shipped east and west; butts, west; faces, north; greatest rise southeast; sample collected from No. 2 of section in room No. 1, first left, by D. D. Teets, Jr.; R. B. Gordon, Supt., authority for data."

The analysis and heat tests of the sample are given under **No. 10** in the table of coal analyses at the end of this chapter.

Kroger Gale Coal Co., Polar Mine.—Map No. 11.

Location, ¾ mile southeast of McWhorter; Redstone coal.

		Ft.	In.
1.	Slate		
2.	Coal	6	0
3.	Slate		

"Tidal elevation, 1400', aneroid; principal office, Cincinnati, Ohio; daily capacity, 225 tons; 8 laborers and 30 miners employed; mule haulage; used for steam, gas and domestic fuel; shipped east and west; butts, N. 88° W.; face, N. 2° E.; greatest rise southwest; sample collected from No. 2 of section by D. D. Teets, Jr.; O. F. Limer, Supt., authority for data."

The analysis and heat tests of the sample collected at this mine are given under **No. 11** in the table of coal analyses at the end of this chapter.

The same table also gives the average analysis, heat determinations, and fuel ratios of six samples of Redstone coal, showing the latter bed to be approximately one per cent. lower in sulphur; 150 B.T.U. higher in heat value for each pound of coal; and slightly higher in fuel ratio than the average of 74 samples of Pittsburgh coal from Harrison county, also given in this table.

Quantity of Redstone Coal Available.

It is quite difficult to approximate the available tonnage of the Redstone coal bed in the Doddridge-Harrison area, but a careful perusal of the data given in the discussion of this bed on pages 203-212 will show that this vein of minable thickness is confined to the southeastern border of

Harrison county. The **approximate northern boundary line where the Redstone coal of commercial thickness and purity disappears,** along with its crop where fulfilling these conditions, is indicated by an appropriate symbol on the economic geology map accompanying this report. The commercial area of this coal as thereon outlined has been determined with a planimeter by Mr. Reger, the results of which are given in square miles in the table below. From a study of the several sections of this seam, the writer, in estimating the approximate available tonnage, feels safe in assuming a thickness of **5 feet** spread out over the areas designated in the table. Figuring on the basis of 25 cubic feet to the short ton, the following results are obtained:

Table Showing Approximate Available Redstone Coal.

By Districts	Sq. Miles	Acres	Cubic feet of Coal	Short Tons of Coal
Harrison County:.				
Union	3.8	2,432	529,689,600	21,187,584
Simpson	1.0	640	139,392,000	5,575,880
Grant	3.5	2,240	487,872,000	19,514,880
Elk	4.4	2,816	613,324,800	24,532,992
Totals	12.7	8,128	1,770,278,400	70,811,136

The Pittsburgh Coal.

The Pittsburgh coal is the next bed of economic importance below the Redstone seam, and comes at the base of the Monongahela series. A detailed description of its geology, distribution and structure in the Doddridge-Harrison area, is given on pages 216-218 of this report.

Before taking up the discussion of the commercial mines in this coal in Harrison county, several sections will first be given southward and westward across the latter area at widely scattered country banks not adjacent to the localities of the present mining operations in this vein.

In the northeastern corner of Harrison county, the writer collected a sample for analysis and obtained the following data at an opening in the Pittsburgh coal, located on Horner run, 1.5 miles southwest of Boothsville:

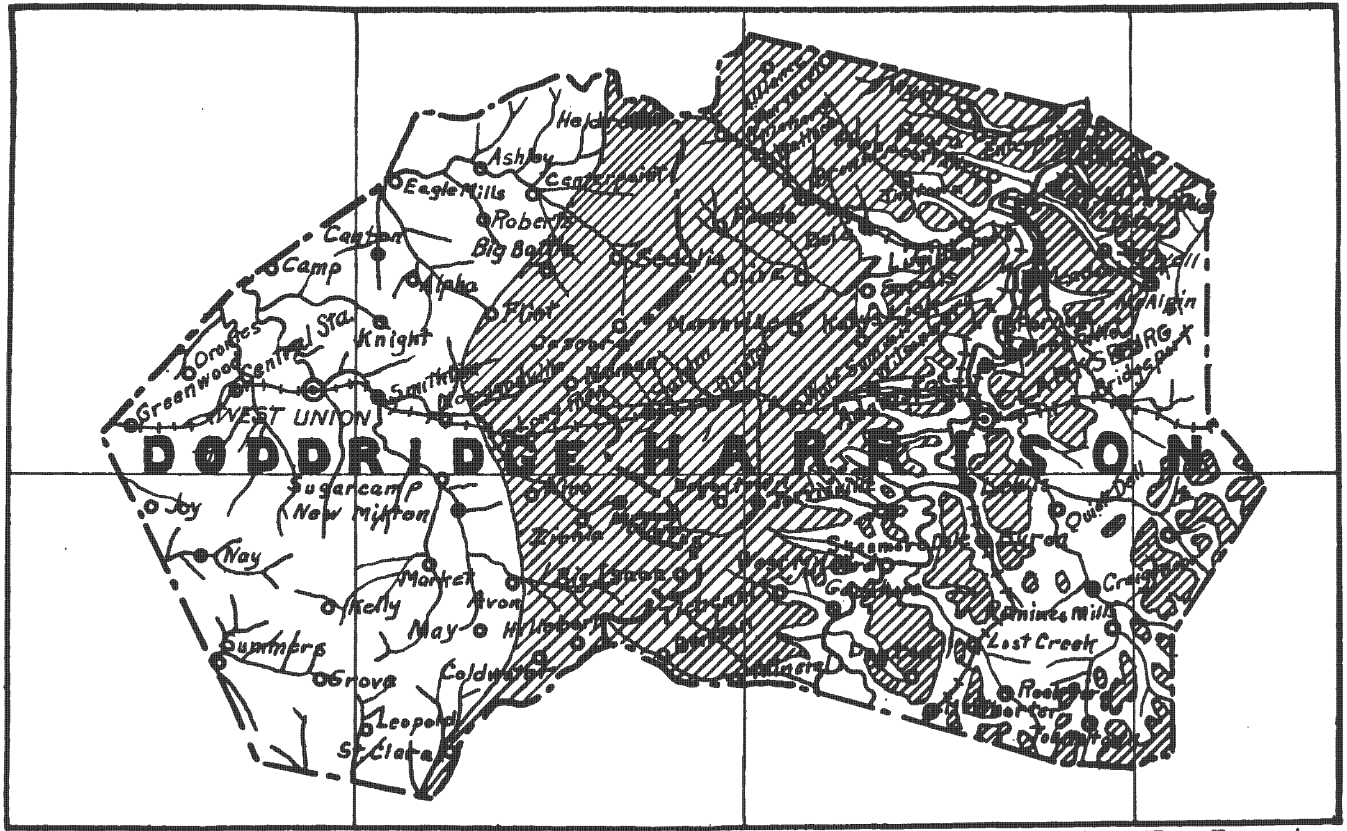


Fig. 5.—Line shading shows approximate area of available Pittsburgh coal in both counties. (See Economic Geology Map).

J. R. Bartlett Mine.—No. 26 on Map.

			Feet.	Inches.
Slate, black				
Coal	2'	10"		
Bone	0	1		
Coal	0	8		
Bone	0	0½		
Coal	4	6	8'	1½

Concealed by water.
(Elevation of coal, 1180' A. T. by spirit level).

The sample for analysis was collected from a freshly dug stock pile at the mine entrance, the composition and fuel value of which, as reported by Prof. Hite, is found under **No. 26** in the table of coal analyses at the end of this chapter. The results reveal a high grade coal, considerably above the average for this bed in Harrison.

The following section was measured at the Daniel Riblett coal mine in the Pittsburgh bed, located on Shinn's run, 0.6 mile northwest of Saltwell:

			Feet.	Inches.
Shale, visible, sandy			6	0
Sandstone, flaggy			3	0
Shale, sandy			1	6
Coal	0'	6"		
Shale, gray	0	2		
Coal	3	0		
Bone	0	1		
Coal	0	7		
Bone	0	0½		
Coal	4	10	9	2½
Fire clay and sandy shale			22	4
Coal, Little Pittsburgh			0	8

In the extreme southeastern point of Simpson district, and along the eastern border of Elk and the southern border of Grant, the Pittsburgh coal apparently thins down 1 to 3 feet from its total section in the northern portion of the county, the most of which seems to take place above the "bands" or twin slates. The detailed structure of the bed in the southern point of Simpson is exhibited in the Brushy Fork section, page 208.

D. B. Reger reports the coal only 4 feet thick in a country bank located 1.7 miles due east of Grassland on the waters of Stonecoal run.

Five miles and a half southwestward the writer measured the following section at the John W. Bean mine in the Pittsburgh bed, located near the low gap, one mile northwest of Peeltree:

			Feet.	Inches.
Shale				
Coal	2′	4 ″		
Slate, black	0	0⅛		
Coal	0	5½		
Bone	0	1		
Coal	3	6	6	4⅝

(Elevation, 1270′ A. T., aneroid).

About 4 miles southwestward there occurs an opening in this coal on the Gary Harris farm, a section of which is given in connection with Harris mine (No. 7 on map) in the Redstone bed, page 209.

Passing westward to a point on the north side of the road in the low gap, 1.3 miles southwest of Rockford, the Pittsburgh coal crops at an elevation of 1400′ A.T. by aneroid. Here it is only 4 to 5 feet thick.

The following section of the Pittsburgh coal was measured at an opening located one-fourth mile northwest of McWhorter:

			Feet.	Inches.
1. Sandstone, in situ?			1	0
2. Slate, black			1	0
3. Coal	0′	6″		
4. Bone	0	1		
5. Coal	3	11	4	6
6. Fire clay				

The "breast coal" of Stevenson has apparently thinned away entirely in this portion of Harrison county.

Five miles northwestward D. B. Reger collected a sample for analysis and measured the following section at a country bank in the Pittsburgh coal, located 0.6 mile northwest of Goodhope:

Jacob Post Mine.—No. 83 on Map.

			Feet.	Inches.
1. Sandstone, Lower Sewickley			30	0
2. Concealed			84	0
3. Coal, slaty	1′	0 ″		
4. Slate	0	0½		

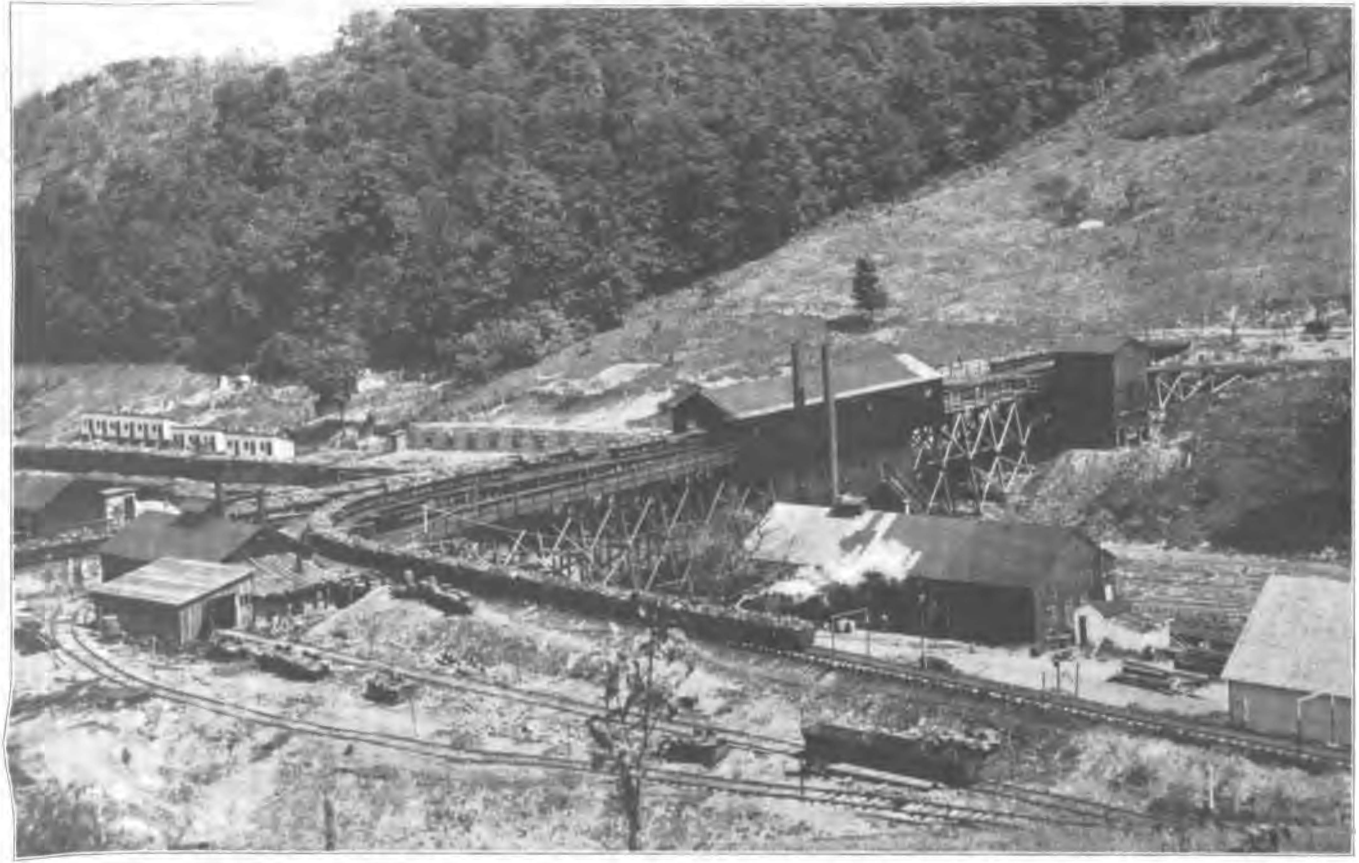


PLATE XVIII.—View showing Tipple and Coke Ovens of the Byron Mine of the Hutchinson Coal Co.—No. 80 on Map.

				Feet.	Inches.
5.	Coal	1	2		
6.	Slate	0	0½		
7.	Coal	1	5		
8.	Slate	0	0¼		
9.	Coal	1	4		
10.	Slate	0	0¼	..	
11.	Coal	1	5	6	5½
12.	Shale, gray				

"Sampled Nos. 7-11 inclusive of section; coal used for local domestic fuel; elevation of bed, 1175' A. T., by aneroid."

The composition and calorific value of the sample collected here is given under No. 83 in the table of coal analyses at the end of this chapter.

Southwestward on Two Lick run the writer measured the following section at a country bank in the Pittsburgh coal, located 1.3 miles south of Tichenal, on the J. H. McDonald farm. The results show that the thinning of the bed has taken place in the "breast" division of the vein:

			Feet.	Inches.
Limestone, yellowish and hard, Redstone			8	0
Concealed			10	0
Slate, sandy			1	0
Bone	0'	1½"		
Coal	3	10½	4	0
Fire clay				

Four miles northward in the east edge of Jarvisville, the Pittsburgh coal was once opened on the land of Wm. Jarvis by a slope driven 25 to 30 feet below the level of the surface at entrance. The mine was abandoned on account of an explosion, according to information furnished Mr. Reger, who also reports the bed about 7 feet thick.

Commercial Mines in Pittsburgh Coal.

As mentioned on preceding pages, the only commercial mines in the Pittsburgh coal in the Doddridge-Harrison area are located in Harrison county along West Fork river and its tributaries. The accurate location of any mine is designated by an appropriate symbol along with its serial number on the economic geology map accompanying this report. The serial numbers are consecutive and roughly arranged from north to south, this map number in each instance corresponding to the number of the same mine as listed in the table of coal analyses at the end of this chapter, in which table the Pittsburgh coal results are represented by Nos. 12-84 inclusive. These mines were all visited in the latter part of 1910, when a section was measured of the coal, mine data collected, and a sample obtained for analysis, this work, with two or three exceptions, being performed by David B. Reger and D. D. Teets, Jr., of the Survey staff. The sampling was done as far as possible according to the methods employed by the Fuel Testing Department of the U. S. Geological Survey. The data obtained at these mines will now be considered from north to south across the county in order of the map numbers of the mines.

Marion Gas Coal Co., Bingamon Mine.—No. 12 on Map.

Location, 1 mile north of Enterprise; Pittsburgh coal.

				Feet.	Inches.
1.	Coal, "head"	0'	10 "		
2.	Coal	2	0		
3.	Bone	0	0¾		
4.	Coal	0	8		
5.	Bone	0	0¾		
6.	Coal	4	3	7	10½
7.	Slate				

"Tidal elevation, 890', spirit level; principal office, Greensburg, Pa.; daily capacity, 400 tons; 18 laborers and 27 miners employed; electric haulage; used for steam and gas; shipped all directions; butts, N. 80° W.; faces, N. 10° E.; greatest rise, southeast; sample collected from Nos. 2, 4 and 6 of section in Main entry by D. D. Teets, Jr.; J. B. Weightman, Supt., authority for data."

The composition and calorific value of the sample is given under No. 12 in the table of coal analyses at the end of this chapter. The "head" coal (No. 1 of section) is not taken down mainly on account of its sulphurous character, and its indirect aid in helping to support the roof, in that it prevents the air from disintegrating the overlying limy shales, thus obviating bad falls of slate.

Consolidation Coal Co. No. 49 (Enterprise).—No. 13 on Map.

Located at Enterprise; **Pittsburgh coal.**

				Feet.	Inches.
1.	Coal, "head"	1'	0"		
2.	Coal	2	5		
3.	Bone	0	1		
4.	Coal	0	5		
5.	Bone	0	0¼		
6.	Coal	4	5	8	4¼

"Tidal elevation, 915', aneroid; owned by J. N. Camden heirs; principal offices, Fairmont; daily capacity, 1000 tons; 70 laborers and 76 miners employed; used for steam, gas and domestic fuel; shipped east and west; butts, N. 80° W.; faces, N. 10° E.; greatest rise, southeast; sampled from Nos. 2, 4 and 6 of section in Room No. 10 off 4th Right Heading, by D. D. Teets, Jr.; H. L. Ice, Assistant Supt., authority for data."

For analysis and calorific value of sample, see table of coal analyses at the end of this chapter, under No. 13.

This mine was once sampled by S. D. Brady for the State Survey, and the proximate analysis published in Vol. II, page 205 under No. 38.

Monongah Fuel Co., Gallihue Mine.—No. 13A on Map.

Located ½ mile south of Kilarm; **Pittsburgh coal.**

				Feet.	Inches.
1.	Draw slate				
2.	Coal, "head", bony	1'	0"		
3.	Coal	1	4		
4.	Bone	0	1		
5.	Coal	0	7		
6.	Bone	0	0½		
7.	Coal	4	3	7	3½
8.	Shale, gray				

"Tidal elevation, 1045', aneroid; principal office, Monongah; daily capacity, 190 tons; 7 laborers and 25 miners employed; horse haulage; used for steam; shipped east and west; butts, N. 83° 09' W.; faces, N. 6° 51' E.; greatest rise, south; sample collected from Nos. 3, 4, 5, 6 and 7 of section in Room No. 2 First Left heading by D. B. Reger; B. A. Wilson, foreman, authority for data."

The composition, calorific value and fuel ratio are given under No. 13A in the table of coal analyses at the end of this chapter.

Consolidation Coal Co. No. 40 (Viropa).—No. 14 on Map.

Located at Viropa; **Pittsburgh coal.**

				Feet.	Inches.
1.	Coal, "head"	1'	3 ″		
2.	Coal	1	5		
3.	Bone	0	2		
4.	Coal	0	3½		
5.	Bone	0	0¾		
6.	Coal	0	4		
7.	Bone	0	0½		
8.	Coal	4	8	8	2¾
9.	Slate				

"Tidal elevation, 930′, aneroid; principal office, Fairmont; daily copacity, 600 tons; 48 laborers and 56 miners employed; used for steam, gas and domestic fuel; shipped east and west; butts, N. 80° W.; faces, N. 10° E.; sample collected from Nos. 2, 4, 6 and 8 in Room No. 1, 7th Left Heading, by D. D. Teets, Jr.; H. L. Ice, Assistant Supt., authority for data."

The composition and calorimeter tests are given under No. 14 in the table of coal analyses at the end of this chapter.

This mine was once sampled for the State Survey by S. D. Brady, and the proximate analysis published in Vol. II, page 206, under No. 65.

Consolidation Coal Co. No. 65 (Solon).—No. 16 on Map.

Located at southwest edge of Shinnston; **Pittsburgh coal.**

				Feet.	Inches.
1.	Coal, "head"	1′	6 ″		
2.	Coal	1	3		
3.	Bone	0	0¼		
4.	Coal	0	7		
5.	Bone	0	0¾		
6.	Coal	4	10	8	3
7.	Slate				

"Tidal elevation, 910′, aneroid; owned by J. N. Camden Heirs; principal office, Fairmont, W. Va.; daily capacity, 150 tons; 7 laborers and 20 miners employed; mule haulage; used for steam and domestic fuel; shipped south, east and west; butts, N. 78° W.; faces, N. 12° E.; greatest rise, dips in all directions; sample collected from Nos. 2, 4 and 6 of section in first Right, off Main Butt, by D. D. Teets, Jr.; L. V. Reamer, foreman, authority for data."

The composition, calorific value and fuel ratio are given under No. 16 in the table of coal analyses at the end of this chapter.

This mine was once sampled by S. D. Brady for the State Geological Survey, and the proximate analysis published in Vol. II, page 205, under No. 43.

Consolidation Coal Co. No. 66 (Riverdale).—No. 15 on Map.

Located 0.7 mile northeast of Shinnston; Pittsburgh coal.

				Feet.	Inches.
1.	Coal, "head"	1′	0 ″		
2.	Coal	1	9		
3.	Bone	0	1		
4.	Coal	0	3		
5.	Bone	0	0½		
6.	Coal	0	3		
7.	Bone	0	0¾		
8.	Coal	4	9	8	2¼
9.	Slate				

"Tidal elevation, 920′, aneroid; owned by D. M. Shinn Heirs; principal office, Fairmont; daily capacity, 275 tons; 20 laborers and 30 miners employed; used for steam, gas and domestic fuel; shipped east and west; butts, N. 80° W.; faces, N. 10° E.; sample collected from Nos. 2, 4, 6 and 8 of section, by D. D. Teets, Jr.; Harry Hickinbotham, Assistant Supt., authority for data."

For composition, calorific value and fuel ratio of this sample, see table of coal analyses at the end of this chapter under No. 15.

This mine was once sampled for the State Geological Survey by S. D. Brady, and the proximate analysis published in Vol. II, page 205, under No. 39.

Consolidation Coal Co. No. 51 (Ehlen).—No. 17 on Map.

Located 0.3 mile S. W. of Shinnston; Pittsburgh coal.

				Feet.	Inches.
1.	Coal, "wild"	0′	4″		
2.	Coal	2	6		
3.	Bone	0	1		
4.	Coal	0	7		
5.	Bone	0	1		
6.	Coal	4	9	8	4
7.	Slate				

"Tidal elevation, 910′, aneroid; owned by Moore, Fleming and Horner; principal office, Fairmont; daily capacity, 300 tons; 25 laborers and 50 miners employed; used for steam purposes; shipped in all directions; butts, N. 78° W.; faces, N. 12° E.; greatest rise, all directions; sample collected from Nos. 2, 4 and 6 of section at Pillar

No. 10 in 2nd Right Heading off 1st Left Face, by D. D. Teets, Jr.; Thomas Jarrett, Jr., Supt., and authority for data. There seems to be no real head coal, but, instead, a kind of mixture of slate and coal is found above coal ranging from 1 inch to 7 or 8 inches in thickness."

The composition, calorific value and fuel ratio are given under No. 17 in the table of coal analyses at the end of this chapter.

The above mine was once sampled for the State Survey by S. D. Brady and the proximate analysis published in Vol. II, page 205, under No. 42.

Consolidation Coal Co. No. 42 (Robinson Run).
No. 1 on Map.

Located at mouth of Robinson run; **Pittsburgh coal.**

				Feet.	Inches.
1.	Coal, "head"	0'	8 "		
2.	Coal	1	1		
3.	Bone	0	0½		
4.	Coal	0	3		
5.	Bone	0	1		
6.	Coal	0	1		
7.	Bone	0	3		
8.	Coal	0	4		
9.	Bone	0	1		
10.	Coal	4	6	7	4½
11.	Slate				

"Tidal elevation, 930', aneroid; owned by Lucas; principal office, Fairmont; daily capacity, 225 tons; 10 laborers and 25 miners employed; used for steam, gas and domestic fuel; shipped east and west; sample collected from Nos. 2, 4, 6, 8 and 10 in the bottom of 2nd Left Butt, by D. D. Teets, Jr.; S. E. Cunningham, assistant mine foreman, authority for data."

The composition, calorific value and fuel ratio of the coal sample are given in the table of coal analyses at the end of this chapter under No. 18.

Haywood Coal Mining Co., Haywood Mine.—No. 19 on Map.

Located ½ mile northeast of Haywood; **Pittsburgh coal.**

				Feet.	Inches.
1.	Coal, "head"	0'	10 "		
2.	Coal	1	5		
3.	Bone	0	0¼		
4.	Coal	1	0		
5.	Bone	0	1		
6.	Coal	5	1	8	5¼
7.	Slate				

"Owned by Martin Heirs; principal office, Pittsburgh, Pa.; daily capacity, 200 tons; 8 laborers and 20 miners employed; mule haulage; used for steam; shipped east and west; butts, N. 78° W.; faces, N. 12° E.; greatest rise, northwest; sample collected from Nos. 2, 4 and 6 of section in Room No. 10, 1st Right; G. H. Wisser, Supt., authority for data."

The composition, calorific value and fuel ratio are given in the table of coal analyses at the end of this chapter, under No. 19.

Consolidation Coal Co. No. 36 (Lucas).—No. 20 on Map.

Located ¼ mile northwest of Haywood; **Pittsburgh coal.**

				Feet.	Inches.
1.	Coal, "head"	0′	6″		
2.	Coal	1	6		
3.	Bone	0	1		
4.	Coal	0	8½		
5.	Bone	0	1		
6.	Coal	4	8	7	6½

"Tidal elevation, 950′ aneroid; principal office, Fairmont; daily capacity, 225 tons; 14 laborers and 20 miners employed; horse haulage; used for steam, gas and domestic fuel; shipped east and west; butts, N. 80° W.; faces, N. 10° E.; greatest rise, southwest; sample collected from Nos. 2, 4 and 6 of section in Room No. 5, 4th Right Heading, by D. D. Teets, Jr.; D. A. Bird, mine foreman, authority for data."

The composition, calorific value and fuel ratio of the sample are given under No. 20 in the table of coal analyses at the end of this chapter.

Consolidation Coal Co. No. 54 (Pooz).—No. 21 on Map.

Located ¼ mile northwest of Haywood; **Pittsburgh coal.**

				Feet.	Inches.
1.	Coal, "head"	1′	0″		
2.	Coal	1	10		
3.	Bone	0	1		
4.	Coal	0	5		
5.	Bone	0	0¾		
6.	Coal	4	6	7	10¾
7.	Slate				

"Tidal elevation, 960′, aneroid; principal office, Fairmont; daily capacity, 125 tons; 15 laborers and 23 miners employed; mule haulage; used for steam, gas and domestic fuel; shipped east and west; butts, N. 77° W.; face, N. 13° E.; sample collected from Nos. 2, 4 and 6 of section by D. D. Teets, Jr.; L. C. Dent, mine foreman, authority for data."

For the composition, calorific value and fuel ratio, see No. 21 in the table of coal analyses at the end of this chapter.

Virginia and Maryland Coal Corporation, Willard No. 2 Mine.

No. 22 on Map.

Located 2 miles southeast of Shinnston; Pittsburgh coal.

				Feet.	Inches.
1.	Coal, "head"	1'	0"		
2.	Coal	1	1		
3.	Bone	0	1		
4.	Coal	0	8		
5.	Bone	0	1		
6.	Coal	5	4	8	3
7.	Slate				

"Tidal elevation, 1035', spirit level; principal office, Richmond, Va.; 2 laborers and 7 miners employed; used for steam and gas; shipped east; butts, N. 77° 30' W.; faces, N. 12° 30' E.; greatest rise, southeast; sample collected from Nos, 2. 4 and 6 of section by D. D. Teets, Jr.; A. Lisle White, Supt., authority for data. This mine is just being opened (Oct. 25, 1910); do not know just what its capacity may be."

For the composition, calorific value and fuel ratio, see No. 22 in the table of coal analyses at the end of this chapter.

Virginia and Maryland Coal Corporation, Willard No. 1 Mine.

No. 23 on Map.

Located 2 miles southeast of Shinnston on Mudlick run; Pittsburgh coal.

				Feet.	Inches.
1.	Coal, "head"	1'	1"		
2.	Coal	2	0		
3.	Bone	0	1		
4.	Coal	0	8		
5.	Bone	0	1		
6.	Coal	4	5	8	4
7.	Slate				

"Tidal elevation, 1035', spirit level; principal office, Richmond, Va.; daily capacity, 1000 tons; 31 laborers and 100 miners employed; mule haulage; used for steam and gas; shipped east; butts, N. 77° 30' W.; faces, N. 12° 30' E.; greatest rise, southeast; sample collected from Nos. 2, 4 and 6 of section in Room No. 7 of 3rd East Heading by D. D. Teets, Jr.; A. Lisle White, Supt., authority for data."

For the composition, calorific value, and fuel ratio, see No. 23 in the table of coal analyses at the end of this chapter.

Consolidation Coal Co. No. 61 (Owings).—No. 24 on Map.

Located 2½ miles southeast of Shinnston, at Owings; **Pittsburgh coal.**

				Feet.	Inches.
1.	Draw slate				
2.	Coal, "head"	1′	0″		
3.	Coal	1	2		
4.	Bone	0	1		
5.	Coal	0	4		
6.	Bone	0	0¼		
7.	Coal	0	3		
8.	Bone	0	1		
9.	Coal	4	9	7	8¼
10.	Slate				

"Tidal elevation, 1060′, aneroid; principal office, Fairmont; daily capacity, 125 tons; 5 laborers and 12 miners employed; electric haulage; used for steam; shipped east and west; butts, N. 75° W.; faces, N. 15° E.; greatest rise, southeast; sample collected from head coal No. 2 of section and also the regular sample from Nos. 3, 5, 6, 7 and 9 of section by D. B. Reger; E. G. Vincent, foreman, authority for data. This is a new mine (Dec. 22, 1910) opposite No. 32 of Consolidation series and uses the same tipple. Practically all the coal is recovered."

The composition, calorific value and fuel ratio of both samples are given under No. 24 in the table of coal analyses at the end of this chapter, the "head" coal being so designated in the table.

In the above mine, the "head" coal shows up better in sulphur, B.T.U., and fuel ratio rating than the main mining section of the bed. The phosphorus, however, is much higher in the former division of the coal.

Consolidation Coal Co. No. 32 (Owings).—No. 25 on Map.

Located 2½ miles southeast of Shinnston at Owings; **Pittsburgh coal.**

				Feet.	Inches.
1.	Draw slate				
2.	Coal, "head"	0′	11 ″		
3.	Coal	1	2		
4.	Bone	0	1		
5.	Coal	0	4		
6.	Bone	0	0½		
7.	Coal	0	3		
8.	Bone	0	1		
9.	Coal	4	5		
10.	Sulphur band	0	2	7	5½
11.	Slate				

"Elevation, 1060′, aneroid; principal office, Fairmont; daily capacity, 450 tons; 25 laborers and 50 miners employed; electric haulage; used for steam; shipped east and west; butts, N. 80° W.; faces, N. 10° E.; greatest rise, southeast; sample collected from Nos. 3, 5, 6, 7 and 9 of section in Room No. 5 on No. 2 Butt, left of manway, by D. B. Reger; E. G. Vincent, foreman, authority for data; nominal recovery, 95 per cent, but foreman says they get 99½ per cent."

For the composition, calorific value and fuel ratio, see No. 25 in the table of coal analyses at the end of this chapter.

The ten following mines are located on the waters of Tenmile creek along the W. Va. Short Line Branch of the B. & O. R. R. and are arranged from west to east:

Short Line Coal Co., Girard No. 2 Mine (new opening). No. 27 on Map.

Located 0.8 mile northwest of Dola; Pittsburgh coal.

				Feet.	Inches.
1.	Coal, "head", thickness concealed......				
2.	Coal	0′	11 ″		
3.	Bone	0	0½		
4.	Coal	0	2		
5.	Bone	0	0¼		
6.	Coal	0	4		
7.	Bone	0	0¾		
8.	Coal	4	6	6	0½
9.	Slate				

"Tidal elevation, 1005′, aneroid; owned by F. M. Piggott; principal office, 1010 Penn Square Building, Philadelphia, Pa.; for capacity and labor see Mine No. 28 (next mine); used for steam; shipped to lakes; butts, N. 75° W.; faces, N. 15° E.; greatest rise, northeast; sample collected from Nos. 2, 4, 5, 6 and 8, about 100′ from outcrop, by D. B. Reger; P. F. Cogar, Supt., and authority for data. This is a new opening just made in 1910. Coal is taken out through hill to Map No. 28 tipple."

For the composition, calorific value and fuel ratio, see No. 27 in the table of coal analyses at the end of this chapter.

Short Line Coal Co., Girard No. 2 Mine (old opening). No. 28 on Map.

Located 0.5 mile northwest of Dola; Pittsburgh coal.

				Feet.	Inches.
1.	Coal, "head", thickness concealed.....				
2.	Coal	0′	3 ″		
3.	Bone	0	0¾		
4.	Coal	0	4		

				Feet.	Inches.
5.	Slate	0	0¼		
6.	Coal	0	8		
7.	Slate	0	0¼		
8.	Coal	0	6		
9.	Bone	0	0½		
10.	Coal	0	7		
11.	Bone	0	0¾		
12	Coal	1	7		
13.	Slate	0	0¼		
14.	Coal	2	9	6	10¾
15.	Slate				

"Tidal elevation, 1045′, aneroid; owned by F. M. Piggott; principal office, 1010 Penn Square Building, Philadelphia, Pa.; daily capacity, 300 tons; 20 laborers and 50 miners employed; rope haulage; used for steam; shipped to lakes; butts, N. 75° W.; faces, N. 15° E.; greatest rise, N. E.; sample collected from Nos. 2, 4, 5, 6, 7, 8, 9, 10, 12, 13 and 14 of section by D. B. Reger; P. F. Cogar, Supt., authority for data."

For the composition, calorific value and fuel ratio, see No. 28 in the table of coal analyses at the end of this chapter.

Fayette Coal Co., Fayette Mine.—No. 29 on Map.

Located at Dola; **Pittsburgh coal.**

				Feet.	Inches.
1.	Coal, "head"	1′	0 ″		
2.	Coal	1	1		
3.	Bone	0	0¼		
4.	Coal	0	7		
5.	Bone	0	1		
6.	Coal	4	3	7	0¼
7.	Slate				

"Tidal elevation, 1050′, aneroid; owned by J. Allen Swiger; principal office, Uniontown, Pa.; daily capacity, 300 to 350 tons; 15 laborers and 25 miners employed; mule haulage; used for steam and domestic fuel; shipped east and west; butts, N. 80° W.; faces, N. 10° E.; greatest rise, southeast; recovery, 90 per cent; sample collected from Nos. 2, 4 and 6 of section in Main Heading by D. D. Teets, Jr.; B. T. Grieves, Supt., authority for data."

For the composition, calorific value and fuel ratio of the sample, see No. 29 in the table of coal analyses at the end of this chapter.

National Coal Co., National Mine.—No. 30 on Map.

Located 0.5 mile S. E. of Dola; **Pittsburgh coal.**

				Feet.	Inches.
1.	Coal, "head"	0′	8 ″		
2.	Coal	1	8		

				Feet.	Inches.
3.	Bone	0	0⅛		
4.	Coal	0	7		
5.	Bone	0	1		
6.	Coal	4	0	7	0½
7.	Slate				

"Tidal elevation, 1050′, aneroid; operated on lease; principal office, Baltimore, Md.; daily capacity, 175 tons; 9 laborers and 35 miners employed; mule haulage; used for steam; shipped east and west; butts, N. 80° W.; faces, N. 10° E.; greatest rise, southeast; sample collected from Nos. 2, 4 and 6 of section in Room No. 1, 3rd Left, by D. D. Teets, Jr.; N. B. Whitehair, Supt., authority for data. There is no distinct separation of "head" coal and coal immediately below it. About 8″ is left up for protection of roof."

For the composition, calorific value and fuel ratio, see No. 30 in the table of coal analyses at the end of this chapter.

Swiger Coal Co., Gilbert Mine.—No. 31 on Map.

Located 1 mile southeast of Dola at Rosebud; **Pittsburgh coal.**

				Feet.	Inches.
1.	Coal, "head"	0′	9 ″		
2.	Coal	1	1		
3.	Bone	0	0¼		
4.	Coal	0	8		
5.	Bone	0	1		
6.	Coal	4	2	6	9¼
7.	Slate				

"Tidal elevation, 1135′, aneroid; owned by Gilbert Swiger; principal office, Rosebud; daily capacity, 70 tons; 4 laborers and 5 miners employed; mule haulage; used for steam; shipped north; butts, N. 80° W.; faces, N. 10° E.; greatest rise, northwest?; sample collected from Nos. 2, 4 and 6 of section by D. D. Teets, Jr.; J. C. Swiger, foreman, authority for data."

For the composition, calorific value and fuel ratio of the sample, see No. 31 in the table of coal analyses at the end of this chapter.

Peacock Coal Co., Sylvester Mine.—No. 32 on Map.

Located 1 mile southeast of Dola at Rosebud; **Pittsburgh coal.**

				Feet.	Inches.
1.	Coal, "head"	0′	8 ″		
2.	Coal	1	6		
3.	Bone	0	0⅛		
4.	Coal	0	7		
5.	Bone	0	1		
6.	Coal	4	7	7	5⅛
7.	Slate				

"Tidal elevation, 1135′ aneroid; owned by Gilbert Swiger; principal office, Clarksburg; daily capacity, 300 tons; 15 laborers and 23 miners employed; used for steam and domestic fuel; shipped east and west; butts, N. 80° W.; faces, N. 10° E.; greatest rise, northwest; sample collected from Nos. 2, 4 and 6 of section in Room No. 6, 4th Right, by D. D. Teets, Jr., W. B. Blakesmith, Supt., authority for data."

For the composition, calorific value and fuel ratio of the sample, see No. 32 in the table of coal analyses at the end of this chapter.

Rosebud Fuel Co., Rosebud Mine.—No. 33 on Map.

Located at Rosebud, nearly on the axis of Wolf Summit anticline; **Pittsburgh coal.**

				Feet.	Inches.
1.	Coal, "head"	1′	0″		
2.	Coal	1	5		
3.	Bone	0	0½		
4.	Coal	0	8		
5.	Bone	0	1		
6.	Coal	4	3	7	5½

"Tidal elevation, 1135′, aneroid; owned by Gilbert Swiger; principal office, Fairmont; daily capacity, 150 tons; 12 laborers and 15 miners employed; used for steam, gas and domestic fuel; shipped east, west and north; butts, N. 80° W.; faces, N. 10° E.; greatest rise, northwest; sample collected from Nos. 2, 4 and 6 of section by D. D. Teets, Jr.; W. F. Roush, Supt., authority for data."

For the composition, calorific value and fuel ratio of sample, see No. 33 in the table of coal analyses at the end of this chapter.

Lumberport Steam Coal Co., Emery Mine.—No. 34 on Map.

Located 0.3 mile northeast of the mouth of Little Tenmile; **Pittsburgh coal.**

				Feet.	Inches.
1.	Coal, "head"	0′	6″		
2.	Coal	1	6		
3.	Bone	0	0¼		
4.	Coal	0	6		
5.	Bone	0	1		
6.	Coal	5	0	7	7¼
7.	Slate				

"Tidal elevation, 1110′, aneroid; principal office, Lumberport; daily capacity, 250 tons, when fully developed; 10 laborers and 30 miners employed; used for steam; shipped east and west; butts, N. 85° W.; faces, N. 5° E.; greatest rise, northwest; sample collected from Nos. 2, 4 and 6 of section in first Butt parallel by D. D. Teets, Jr.; L. L. Gibson, Supt., authority for data."

For the composition, calorific value and fuel ratio, see table of coal analyses at the end of this chapter, under No. 34.

Blue Ridge Coal Co., Thompson Mine.—No. 35 on Map.

Located at east edge of Lumperport; **Pittsburgh coal.**

			Feet.	Inches.
1. Coal, "head"	0′	6 ″		
2. Coal	1	6		
3. Bone	0	0¼		
4. Coal	0	7		
5. Bone	0	1		
6. Coal	4	9	7	5¼
7. Slate				

"Tidal elevation, 1000′, aneroid; owned by Griffin; principal office, Clarksburg; daily capacity, 250 tons; 7 laborers and 20 miners employed; mule haulage; used for steam; shipped east and west; butts, N. 80° W.; faces, N. 10° E.; greatest rise, southwest; sample collected from Nos. 2, 4 and 6 of section in Room No. 16, 1st Right, by D. D. Teets, Jr.; W. H. Sandridge, Supt., authority for data."

For composition, calorific value and fuel ratio, see No. 35 in the table of coal analyses at the end of this chapter.

Hero Coal and Coke Co., Hero Mines.—No. 36 on Map.

Located ½ mile northeast of Lumberport; **Pittsburgh coal.**

			Feet.	Inches.
1. Coal, "head"	0′	9 ″		
2. Coal	1	10		
3. Bone	0	0½		
4. Coal	0	7		
5. Bone	0	0½		
6. Coal	4	7	7	10
7. Slate				

"Tidal elevation, 970′, aneroid; principal office, Uniontown, Pa.; daily capacity, 300 tons; 7 laborers and 35 miners employed; mule haulage; used for steam and domestic fuel; shipped east and west; butts, N. 79° W.; face, N. 11° E.; greatest rise, northwest; sample collected from Nos. 2, 4 and 6 of section in Room No. 1, 2nd Right Heading, by D. D. Teets, Jr.; Wm. Reid, Supt., and authority for data."

For composition, calorific value and fuel ratio, see No. 36 in the table of coal analyses at the end of this chapter.

Consolidation Coal Co. No. 21 (Gypsy).—No. 37 on Map.

Located at north edge of Gypsy; **Pittsburgh coal.**

			Feet.	Inches.
1. Coal, "head"	1′	0 ″		
2. Coal	1	11		
3. Bone	0	1		
4. Coal	0	4		

				Feet.	Inches.
5.	Bone	0	0¾		
6.	Coal	0	3		
7.	Bone	0	1		
8.	Coal	4	11	8	7¾
9.	Slate				

"Tidal elevation, 908′, aneroid; owned by Monongah Company; principal office, Fairmont; 93 laborers and 43 miners employed; used for steam, gas and domestic fuel; shipped east and west; butts; N. 77° W.; faces N. 13° E.; greatest rise, northwest; sample collected Nov. 2, 1910, from Nos. 2, 4, 6 and 8 of section, by D. D. Teets, Jr.; tipple boss, authority for data."

For composition, calorific value and fuel ratio of the sample, see No. 37 in the table of coal analyses at the end of this chapter.

The old **Maulsby mine (No. 38 on Map)** of the Fairmont Coal Co., located 0.5 mile southeast of Gypsy, had been abandoned in 1910, but it was once sampled for the State Geological Survey by S. D. Brady. and the proximate analysis, as published on page 205 of Vol. 1, under No. 41, is given under No. 38 in the table of coal analyses at the end of this chapter.

Lambert Run Coal Co., Clauson Mine.—No. 39 on Map.

Located ¼ mile west of Meadowbrook, on Short Line Railroad; Pittsburgh coal.

				Feet.	Inches.
1.	Coal, "head"	1′	0 ″		
2.	Coal	2	0		
3.	Bone	0	0⅛		
4.	Coal	0	4		
5.	Bone	0	0½		
6.	Coal	4	6	7	10⅝
7.	Slate				

"Tidal elevation, 990′, aneroid; principal office, Fairmont; daily capacity, 350 tons; 12 laborers and 28 miners employed; used for steam; shipped east; butts, N. 80° W.; faces N. 10° E.; greatest rise, southeast; sample collected from Nos. 2, 4 and 6 of section in air course, 2nd Heading, by D. D. Teets, Jr.; Dorsey Pople, Supt., authority for data."

For the composition, calorific value and fuel ratio, see No. 39 in the table of coal analyses at the end of this chapter.

Consolidation Coal Co. No. 55 (Meadowbrook).
No. 40 on Map.

Located at south edge of Meadowbrook; Pittsburgh coal.

				Feet.	Inches.
1.	Coal, "head"	1′	4 ″		
2.	Coal	1	3		
3.	Bone	0	0¾		
4.	Coal	0	10		
5.	Bone	0	1		
6.	Coal	4	6	8	0¾
7.	Slate				

Tidal elevation, 1050′, aneroid; owned by J. N. Camden Heirs; principal office, Fairmont; daily capacity, 300 tons; 42 laborers and 46 miners employed; electric haulage; used for steam, gas and domestic purposes; shipped east and west; butts, N. 80° W.; faces, N. 10° E.; sample collected from Nos. 2, 4 and 6 of section in Room No. 5, off 10th Butt Heading, off Main Face by D. D. Teets, Jr.; J. H. Nuzum, Supt., authority for data."

For the composition, calorific value and fuel ratio of the samples of main bench and "head" coal see No. 40 in the table of coal analyses at the end of this chapter. The "head" coal is much higher in ash and phosphorus than the main mining division of the bed.

The mine was once sampled by S. D. Brady for the State Geological Survey, and the proximate analysis published on page 206 of Vol. II, under No. 59.

Cook Coal & Coke Co., Girard No. 1 Mine.—No. 41 on Map.

Located 0.6 mile southeast of Meadowbrook; Pittsburgh coal.

				Feet.	Inches.
1.	Coal, "head"	1′	3 ″		
2.	Coal	1	5		
3.	Bone	1	0½		
4.	Coal	0	7		
5.	Bone	0	1		
6.	Coal	4	10	8	2½
7.	Slate				

"Tidal elevation, 975′, aneroid; owned by J. N. Camden Heirs; principal office, Philadelphia, Pa.; daily capacity, 800 tons; 43 laborers and 60 miners employed; electric haulage; used for steam and domestic fuel; shipped east and west; butts, N. 76° W.; faces, N. 14° E.; greatest rise, southeast; sampled from Nos. 2, 4 and 6 of section by D. D. Teets, Jr.; E. P. McAlvin, foreman, authority for data."

For composition, calorific value and fuel ratio, see No. 41 in the table of coal analyses at the end of this chapter.

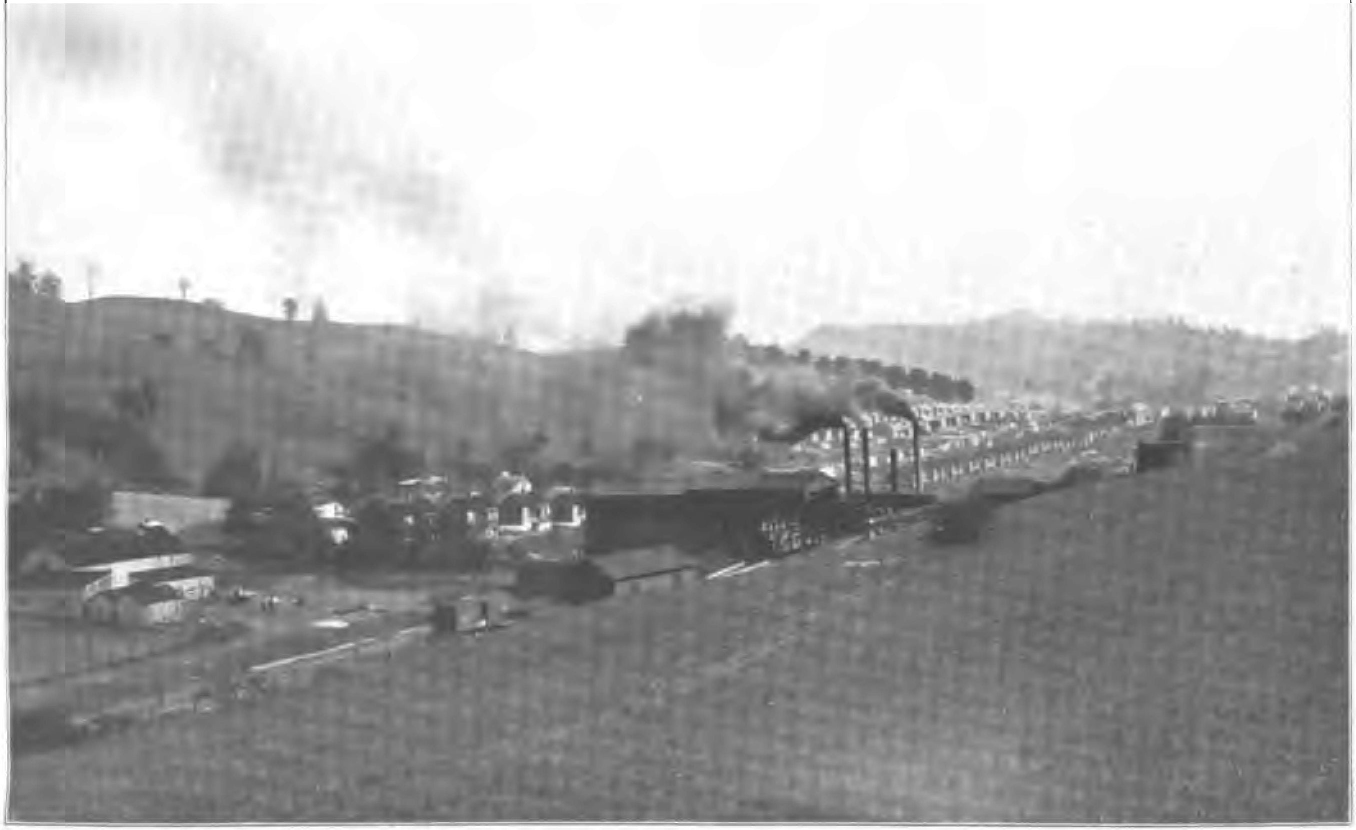


PLATE XIX.—Plant and Town at the Pinnickinnick (No. 25) Mine of the Consolidation Coal Co. near Clarksburg—No. 65 on Map. Also Topography of the Monongahela series.

Harrison County Coal Co., Overholt Mine.—No. 42 on Map.

Located 0.6 mile west of Meadowbrook; **Pittsburgh coal.**

				Feet.	Inches.
1.	Coal, "head"	1'	3"		
2.	Coal	1	3		
3.	Bone	0	0⅛		
4.	Coal	0	8		
5.	Bone	0	1		
6.	Coal	6	6	7	9⅛
7.	Slate				

"Tidal elevation, 1120', aneroid; owned by Overholt Bros.; principal office, Pittsburgh, Pa.; daily capacity, 400 tons; 9 laborers and 29 miners employed; mule haulage; used for steam and gas; shipped in all directions; butts, N. 78° W.; faces, N. 12° E.; greatest rise, southeast; sample collected from Nos. 2, 4 and 6 of section in Main Face heading by D. D. Teets, Jr.; Geo. H. Rustin, Supt., authority for data."

For the composition, calorific value and fuel ratio of the sample, see No. 42 in the table of coal analyses at the end of this chapter.

Hutchinson Coal Co., Erie Mine.—No. 43 on Map.

Located at Erie; **Pittsburgh coal.**

				Feet.	Inches.
1.	Coal, "head"	0'	11"		
2.	Coal	2	0		
3.	Bone	0	0¾		
4.	Coal	0	8		
5.	Bone	0	0¾		
6.	Coal	0	10	8	6½
7.	Slate				

"Tidal elevation, 1110', aneroid; principal office, Fairmont,; daily capacity, 900 to 1,000 tons; 35 laborers and 75 miners employed; electric haulage; used for steam and domestic fuel; shipped in all directions; butts, N. 80° W.; face, N. 10° E.; greatest rise, southeast; sample collected from Nos. 2, 4 and 6 of section by D. D. Teets, Jr.; A. J. Jenkins, Supt., and authority for data."

For the composition, calorific value and fuel ratio of the sample, see No. 43 in the table of coal analyses at the end of this chapter.

The above mine was once sampled by S. D. Brady for the State Geological Survey, and the proximate analysis published on page 205 of Vol. II, under No. 49.

Consolidation Coal Co. No. 33 (Globe).—No. 44 on Map.

Located at Farnum; **Pittsburgh coal.**

				Feet.	Inches.
1.	Coal, "head"	0'	8"		
2.	Coal	1	10		
3.	Bone	0	1		
4.	Coal	0	8		
5.	Bone	0	1		
6.	Coal	4	10	8	2
7.	Slate				

"Tidal elevation, 1030', aneroid; principal office, Fairmont; daily capacity, 200 tons; 7 laborers and 21 miners employed; electric haulage; shipped east and west; butts, N. 80° W.; faces, N. 10° E.; greatest rise, northwest; sample collected from Nos. 2, 4 and 6 of section in Room No. 6, 1st Left off No. 2, Left Face, by D. D. Teets, Jr.; G. E. Kendrick, foreman, authority for data."

For the composition, calorific value and fuel ratio, see No. 44 in the table of coal analyses at the end of this chapter.

The old **Glen Falls mine (No. 45 on map)** of the Fairmont Coal Co., located a short distance due east of the mouth of Fall run, had been abandoned in 1910, but it was once sampled for the State Geological Survey by S. D. Brady, and the proximate analysis as published on page 205 of Vol. II, under No. 48, is given in the table of coal analyses at the end of this chapter, under No. 45.

Consolidation Coal Co. No. 27 (Dunham).—No. 46 on Map.

Located on south side of Fall run at Glen Falls; **Pittsburgh coal.**

				Feet.	Inches.
0.	Shale, gray and soft				
1.	Coal, "head"	1'	6 "		
2.	Coal	0	10		
3.	Bone	0	1¼		
4.	Coal	0	7½		
5.	Bone	0	1		
6.	Coal	5	1	8	2¾
7.	Slate				

"Tidal elevation, 1075', aneroid; principal office, Fairmont; 15 laborers and 30 miners employed; electric haulage; butts, N. 80° W.; faces, N. 10° E.; greatest rise, southwest; recovery, 91½ per cent; sample collected from Nos. 2, 4 and 6 of section at mouth of 10th Right Heading by Ray V. Hennen and D. B. Reger; L. C. Murray, Supt., Walter Miller, foreman, authority for data."

For composition, calorific value and fuel ratio, see No. 46 in the table of coal analyses at the end of this chapter.

Consolidation Coal Co. No. 48 (Fall Run).—No. 47 on Map.

Located on Fall Run, 0.6 mile southeast of Glen Falls; **Pittsburgh coal.**

				Feet.	Inches.
1.	Coal, "head", thickness concealed				
2.	Coal	1′	4 ″		
3.	Bone	0	0⅛		
4.	Coal	0	8½		
5.	Bone	0	0¾		
6.	Coal	5	3	7	4¾
7.	Slate				

"Tidal elevation, 1080′, aneroid; principal office, Fairmont; daily capacity, 350 tons; 19 laborers and 40 miners employed; electric haulage; butts, N. 80° W.; faces N. 10° E.; greatest rise, southeast; sample collected from Nos. 2, 4 and 6 of section in Room No. 4, off 5th Right, by Ray V. Hennen and D. B. Reger; L. C. Murray, Supt.; Walter Miller, foreman, authority for data."

For the composition, calorific value and fuel ratio, see No. 47 in the table of coal analyses at the end of this chapter.

Consolidation Coal Co. No. 62 (Perry No. 3).—No. 48 on Map.

Located ½ mile north of Adamston; **Pittsburgh coal.**

				Feet.	Inches.
1.	Coal, "head"	1′	0 ″		
2.	Coal	0	8		
3.	Bone	0	0¼		
4.	Coal	0	4½		
5.	Bone	0	0½		
6.	Coal	0	5		
7.	Bone	0	1		
8.	Coal	0	7		
9.	Bone	0	1		
10.	Coal	4	2	7	5¼
11.	Slate				

"Tidal elevation, 1005′ aneroid; principal office, Fairmont; daily capacity, 200 tons; 19 laborers and 37 miners employed; mule haulage; used for steam, gas and domestic fuel; shipped east and west; butts, N. 78° W.; faces, N. 12° E.; greatest rise, south; sample collected from Nos. 2, 4, 6, 8 and 10 of section in 1st Right, 3rd North, by D. D. Teets, Jr.; D. Oldroyd, Supt., authority for data."

For the composition, calorific value and fuel ratio of the above sample, see No. 48 in the table of coal analyses at the end of this chapter.

Corona Coal & Coke Co., Harold Mine.—No. 49 on Map.

Located ⅓ mile northeast of Adamston; **Pittsburgh coal.**

				Feet.	Inches.
1.	Coal, "head"	1′	11 ″		
2.	Coal	0	7		
3.	Bone	0	0½		
4.	Coal	0	7		
5.	Bone	0	0½		
6.	Coal	0	0	8	2
7.	Slate				

"Tidal elevation, 1000′, aneroid; principal office, Pittsburgh, Pa.; daily capacity, 700 tons; 30 laborers and 55 miners employed; electric haulage; used for steam, gas and domestic fuel; shipped in all directions; butts, N. 81° W.; faces N. 9° E.; greatest rise, northwest, sample collected from Nos. 2, 4 and 6 of section by D. D. Teets, Jr.; J. E. Clingan, Supt., authority for data."

For the composition, calorific value and fuel ratio, see No. 49 in the table of coal analyses at the end of this chapter.

The 15 following mines in the Pittsburgh coal are located on the waters of Limestone run, westward from Clarksburg, along the main line of the Baltimore & Ohio R. R. (Southwest), and are arranged in order of their map numbers from west to east:

Chas. T. Moore, Phoenix Mine.—No. 50 on Map.
(W. B. Gunton Coal Co.)

Located ½ mile northeast of Wolf Summit; **Pittsburgh coal.**

				Feet.	Inches.
1.	Coal, "head"	0′	6 ″		
2.	Coal	0	6		
3.	Bone	0	0¼		
4.	Coal	0	9		
5.	Bone	0	1		
6.	Coal	4	3	6	1¼
7.	Slate				

"Tidal elevation, 1150′, aneroid; owned by Moore and Douglass; principal office, Pittsburgh, Pa.; daily capacity, 100 tons; 13 laborers and 13 miners employed; used for domestic fuel; shipped west; butts, N. 80° W.; faces, N. 10° E.; greatest rise, southeast; sample collected from Nos. 2, 4 and 6 of section in Main Heading, 3rd Right, by D. D. Teets, Jr.; M. M. Mannix, Supt., authority for data."

For the composition, calorific value and fuel ratio, see No. 50 in the table of coal analyses at the end of this chapter.

At the time this mine was visited by Mr. Teets, it was run under the name given above, but, according to the Annual Report of the Department of Mines of W. Va. for 1910, it is run by the **W. B. Gunton Coal Co.**

O'Gara Coal Co., O'Gara Mine.—No. 51 on Map.

Located ½ mile northeast of Wolf Summit; **Pittsburgh coal.**

				Feet.	Inches.
1.	Coal, "head"	0'	10 "		
2.	Coal	1	4½		
3.	Bone	0	0½		
4.	Coal	0	7½		
5.	Bone	0	0½		
6.	Coal	4	3	7	2
7.	Slate				

"Tidal elevation, 1140', aneroid; owned by Summit Coal Co.; principal office, Chicago, Ill.; daily capacity, 360 tons; 27 laborers and 35 miners employed; used for domestic fuel; shipped west; butts, N. 80° W.; faces, N. 10° E.; greatest rise, southeast; sample collected from Nos. 2, 4 and 6 of section in Room No. 23 South, 3rd Right Heading, by D. D. Teets, Jr.; J. S. Howe, Supt., authority for data."

For the composition, calorific value and fuel ratio, see No. 51 in the table of coal analyses at the end of this chapter.

Hutchinson Coal Co., Delta Mine.—No. 52 on Map.

Located ½ mile northeast of Wolf Summit; **Pittsburgh coal.**

				Feet.	Inches.
1.	Coal, "head"	0'	6 "		
2.	Coal	0	6		
3.	Bone	0	0⅛		
4.	Coal	0	6		
5.	Bone	0	1		
6.	Coal	4	8½	6	5⅝
7.	Slate				

"Tidal elevation, 1110', aneroid; owned by Kelso Thompson; principal office, Fairmont; daily capacity, 400 tons; 10 laborers and 40 miners employed; mule haulage; used for steam and gas; shipped east and west; butts, N. 78° W.; faces, N. 12° E.; greatest rise, southeast; sample collected from Nos. 2, 4 and 6 of section in Main Heading by D. D. Teets, Jr.; C. D. M. Kramer, Supt., authority for data."

For the composition, calorific value and fuel ratio, see No. 52 in the table of coal analyses at the end of this chapter.

The old **Reynoldsville mine (No. 53 on Map),** located one mile eastward from Wolf Summit at Reynoldsville, had been abandoned in 1910, but it was once sampled for the State Survey by S. D. Brady, and the proximate analysis as published on page 206 of Vol. II, under No. 61, is given in the table of coal analyses at the end of this chapter, under No. 53.

Madeira-Hill-Clark Coal Co., Chieftain or No. 4 Mine. No. 54 on Map.

Located 0.9 mile northwest of Wilsonburg; Pittsburgh coal.

				Feet.	Inches.
1.	Coal, "head"	1′	0 ″		
2.	Coal	0	6		
3.	Bone	0	0⅛		
4.	Coal	0	6		
5.	Bone	0	0⅛		
6.	Coal	4	10	6	10⅝
7.	Slate				

"Tidal elevation, 1135′, spirit level; operated on lease; principal office, Fairmont; daily capacity, 100 tons; 4 laborers and 18 miners employed; mule haulage; used for steam, gas and domestic fuel; shipped west; butts, N. 80° W.; faces, N. 10° E.; greatest rise, N. 40° W.; sample collected from Nos. 2, 4 and 6 of section in 2nd Left Heading by D. D. Teets, Jr."

For the composition, calorific value and fuel ratio, see No. 54 in the table of coal analyses at the end of this chapter.

Madeira-Hill-Clark Coal Co. No. 3 (Randolph). No. 55 on Map.

Located 0.9 mile northwest of Wilsonburg; Pittsburgh coal.

				Feet.	Inches.
1.	Coal, "head"	0′	10 ″		
2.	Coal	1	4		
3.	Bone	0	0½		
4.	Coal	0	7		
5.	Bone	0	0¾		
6.	Coal	4	0	6	10¼
7.	Slate				

"Tidal elevation, 1133′, spirit level; operated on lease; principal office, Fairmont; daily capacity, 550 tons; 23 laborers and 62 miners employed; electric and mule haulage; used for steam, gas and domestic fuel; shipped west; butts, N. 80° W.; faces N. 10° E.; greatest rise, N. 40° W.; sample collected from Nos. 2, 4 and 6 of section in Room No. 9 off 4th Left Heading by D. D. Teets, Jr."

For the composition, calorific value and fuel ratio, see No. 55 in the table of coal analyses at the end of this chapter.

Consolidation Coal Co. No. 35 (O'Neil).—No. 56 on Map.

Located 1 mile due north of Wilsonburg; **Pittsburgh coal.**

				Feet.	Inches.
1.	Coal, "head"	0′	8 ″		
2.	Coal	1	8		
3.	Bone	0	1		
4.	Coal	0	8½		
5.	Bone	0	0¾		
6.	Coal	4	6	7	8¼
7.	Slate				

"Tidal elevation, 1050′ aneroid; principal office, Fairmont; daily capacity, 500 tons; 50 laborers and 50 miners employed; rope and mule haulage; used for steam, gas and domestic fuel; shipped east and west; butts, N. 80° W.; faces, N. 10° E.; greatest rise, southeast; sample collected from Nos. 2, 4 and 6 of section in Room No. 15, 4th Right Heading, by D. D. Teets, Jr.; J. R. Elsess, Supt., authority for data."

For the composition, calorific value and fuel ratio, see No. 56 in the table of coal analyses at the end of this chapter.

This mine was once sampled for the State Survey by S. D. Brady, and the proximate analysis published on page 206 of Vol. II, under No. 62.

The old **O'Neil No. 2 mine (No. 57 on map)** of the Fairmont Coal Co. located 0.5 mile due north of Wilsonburg had been abandoned in 1910, but it was once sampled for the State Survey by S. D. Brady, and the proximate analysis as published on page 206 of Vol. II, under No. 63, is given in the table of coal analyses at the end of this chapter, under No. 57.

The two mines in the Pittsburgh coal of the **Washington Coal Co.** (No. 58 and 59 on map), located one mile northeast of Wilsonburg, were shut down in 1910 and for that reason Mr. Reger was unable to collect samples from these operations.

Consolidation Coal Co. No. 50 (Perry No. 1).—No. 60 on Map.

Located 1 mile northwest of Adamston; **Pittsburgh coal.**

				Feet.	Inches.
1.	Coal, "head"	0′	10 ″		
2.	Coal	1	1		
3.	Bone	0	0½		
4.	Coal	0	9		
5.	Bone	0	1		
6.	Coal	4	6	7	3½
7.	Slate				

"Principal office, Fairmont; daily capacity, 500 tons; 16 laborers and 33 miners employed; electric haulage; used for steam, gas and domestic fuel; shipped east and west; butts, N. 80° 30′ W.; faces N. 9° 30′ E:; greatest rise, west; sample collected from Nos. 2, 4 and 6 of section in 1st North Face, off 4th Heading, by D. D. Teets, Jr.; A. V. Morgan, Supt., authority for data. Perry No. 1 and Perry No. 2 both use the same tipple and have the same Consolidation number (No. 50)."

For the composition, calorific value and fuel ratio, see No. 60 in the table of coal analyses at the end of this chapter.

This mine was once sampled by S. D. Brady for the State Survey, and the proximate analysis published on page 205 of Vol. II, under No. 52.

Consolidation Coal Co. No. 50 (Perry No. 2).—No. 61 on Map.

Located 1 mile northwest of Adamston; Pittsburgh coal.

				Feet.	Inches.
1.	Coal, "head"	0′	6″		
2.	Coal	0	9		
3.	Bone	0	0¼		
4.	Coal	0	4		
5.	Bone	0	0¼		
6.	Coal	0	5		
7.	Bone	0	1		
8.	Coal	4	8	6	9½
9.	Slate				

"Principal office, Fairmont; daily capacity, 500 tons; 16 laborers and 42 miners employed; used for steam, gas and domestic fuel; shipped east and west; butts, N. 80° 30′ W.; faces, N. 9° 30′ E.; greatest rise, west; sample collected from Nos. 2, 4 and 6 of section in room No. 6, 5th Right, by D. D. Teets, Jr.; A. V. Morgan, Supt., authority for data."

For the composition, calorific value and fuel ratio, see No. 61 in the table of coal analyses at the end of this chapter.

Madeira-Hill-Clark Coal Co. No. 1 (Waldo) Mine.
No. 62 on Map.

Located 1.5 miles west of Adamston; Pittsburgh coal.

				Feet.	Inches.
1.	Coal, "head"	0′	9″		
2.	Coal	1	0		
3.	Bone	0	1		
4.	Coal	0	8		
5.	Bone	0	1		
6.	Coal	4	11	7	6
7.	Slate				

"Tidal elevation, 1120', aneroid; operated on lease; principal office, Fairmont; daily capacity, 450 to 500 tons; 20 laborers and 50 miners employed; used for steam, gas and domestic fuel; shipped west; butts, N. 80° W.; faces, N. 10° E.; greatest rise, N. 40° W.; sample collected from head coal, No. 1 of section, and the usual sample from Nos. 2, 4 and 6 of section in Room No. 10 off 6th Right Entry by Ray V. Hennen; J. M. Hicks, Supt., authority for data; head coal left up for protection of roof; when removed, overlaying clay disintegrates rapidly."

The composition, calorific value and fuel ratio of the two samples—mining section and "head" coal—are given in the table of coal analyses at the end of this chapter, under No. 62, the latter sample being designated "head" coal in the table, and there shown to be unusually high in **ash** and **sulphur.**

This mine was once sampled by S. D. Brady for the State Geological Survey, and the proximate analysis published on page 206 of Vol. II, under No. 54.

Madeira-Hill-Clark Coal Co. No. 2 (Goff) Mine.
No. 63 on Map.

Located 0.8 mile west of Adamston; **Pittsburgh coal.**

				Feet.	Inches.
1.	Coal, "head"	0'	10"		
2.	Coal	0	11		
3.	Bone	0	0¾		
4.	Coal	0	7¾		
5.	Bone	0	1		
6.	Coal	5	2	7	8½
7.	Slate				

"Tidal elevation, 1100', spirit level; operated on lease; principal office, Fairmont; daily capacity, 550 tons; 23 laborers and 62 miners; mule haulage; used for steam, gas and domestic fuel; shipped west; butts, N. 80° W.; faces, N. 10° E.; greatest rise, northwest; sample collected from Nos. 2, 4 and 6 of section in Room No. 11, off 4th Left Butt, by Ray V. Hennen."

For the composition, calorific value and fuel ratio, see No. 63 in the table of coal analyses at the end of this chapter.

Fairmont & Baltimore Coal & Coke Co., Fairmore Mine
No. 64 on Map.

Located 0.3 mile southwest of Adamston; **Pittsburgh coal.**

				Feet.	Inches.
1.	Coal, "head"	1'	0"		
2.	Coal	0	9		
3.	Bone	0	0½		
4.	Coal	0	7½		

				Feet.	Inches.
5.	Bone	0	1		
6.	Coal	4	10	7	4
7.	Slate				

"Tidal elevation, 1000', aneroid; owned by Jones Heirs; principal office, Baltimore; daily capacity, 300 to 350 tons; 20 laborers and 48 miners employed; rope haulage; used for steam; shipped east and west; butts, N. 80° W.; faces, N. 10°; greatest rise, southeast; sample collected from Nos. 2, 4 and 6 of section in Room No. 4, 1st Right Heading, by D. D. Teets, Jr.; Cleo. Mark, foreman, authority for data."

For the composition, calorific value and fuel ratio, see No. 64 in the table of coal analyses at the end of this chapter.

This mine was once sampled for the State Survey by S. D. Brady, and the proximate analysis published on page 206 of Vol. II, under No. 53.

The three following mines are located northeast of Clarksburg on the waters of Murphy run and Elk creek:

Colsolidation Coal Co., No. 25 (Pinnickinnick).—No. 65 on Map.

Located 0.5 mile northeast of Clarksburg; **Pittsburgh coal.**

				Feet.	Inches.
1.	Coal, "head"	1'	0"		
2.	Coal	2	0		
3.	Bone	0	1		
4.	Coal	1	3		
5.	Bone	0	1		
6.	Coal	3	7	8	0
7.	Slate				

"Principal office, Fairmont; daily capacity, 1000 tons; 65 laborers and 100 miners employed; electric haulage; used for steam, gas and domestic fuel; shipped east and west; butts, N. 80° W.; faces, N. 10° E.; sample collected from Nos. 2, 4 and 6 of section in Room No. 19, 1st Right off 2nd North, by D. D. Teets, Jr.; Thos. Pollock, foreman, authority for data."

For the composition, calorific value and fuel ratio, see No. 65 in the table of coal analyses at the end of this chapter.

This mine was once sampled for the State Survey by S. D. Brady, and the proximate analysis published on page 206 of Vol. II, under No. 57.

Consolidation Coal Co. No. 58 (Despard).—No. 66 on Map.

Located on Murphy run, 1 mile northeast of Clarksburg; Pittsburgh coal.

				Feet.	Inches.
1.	Coal, "head"	1'	0"		
2.	Coal	1	10		
3.	Bone	0	0½		
4.	Coal	0	9		
5.	Bone	0	1		
6.	Coal	5	2	8	10½
7.	Slate				

"Principal office, Fairmont; daily capacity, 200 tons; 17 laborers and 30 miners; used for steam, gas and domestic fuel; shipped east and west; butts, N. 80° W.; faces, N. 10° E.; sample collected from Nos. 2, 4 and 6 of section in Room No. 1, 4th Right, by D. D. Teets, Jr.; R. G. Brooks, Asst. foreman, authority for data."

For the composition, calorific value and fuel ratio, see No. 66 in the table of coal analyses at the end of this chapter.

The mine was once sampled by S. D. Brady for the State Survey, and the proximate analysis published on page 206 of Vol. II, under No. 58.

Consolidation Coal Co. No. 29 (Columbia).—No. 67 on Map.

Located on Murphy run, 1 mile northeast of Clarksburg; Pittsburgh coal.

				Feet.	Inches.
1.	Coal, "head"	0'	11"		
2.	Coal	1	6		
3.	Bone	0	0¾		
4.	Coal	0	7		
5.	Bone	0	1		
6.	Coal	4	8	7	9¾
7.	Slate				

"Owned by Harry F. Blunt and M. M. Parker; principal offices, Fairmont; daily capacity, 600 tons; 37 laborers and 50 miners employed; used for steam, gas and domestic fuel; shipped east and west; butts, N. 80° W.; faces N. 10° E.; greatest rise, south; sample collected from Nos. 2, 4 and 6 of section in Room No. 11, 9th Right Butt, by D. D. Teets, Jr.; M. J. Rooney, foreman, authority for data."

For the composition, calorific value and fuel ratio, see No. 67 in the table of coal analyses at the end of this chapter.

This mine was once sampled for the State Survey by S.

D. Brady, and the proximate analysis published on page 205 of Vol. II, under No. 50.

Consolidation Coal Co. No. 52 (Ocean).—No. 68 on Map.

Located 1.7 miles west of Bridgeport; Pittsburgh coal.

				Feet.	Inches.
1.	Draw slate				
2.	Coal, "head"	1'	8 "		
3.	Coal	0	3		
4.	Bone	0	1		
5.	Coal	0	3		
6.	Bone	0	1¼		
7.	Coal	0	6		
8.	Bone	0	1¼		
9.	Coal	4	9	7	8½
10.	Slate				

"Tidal elevation, 1143.6', spirit level; owned by Bridgeport Gas Co.; principal office, Fairmont; daily capacity, 350 tons; 20 laborers and 60 miners employed; rope haulage; butts, N. 75° W.; faces, N. 15° E.; greatest rise, southeast; sample collected from Nos. 3, 5, 7 and 9 of section in No. 2 Butt, on First Face heading, by D. B. Reger; D. A. Reed, Supt.; F. H. Brooks, foreman, authority for data."

For composition, calorific value and fuel ratio, see No. 68 in the table of coal analyses at the end of this chapter.

This mine was once sampled by S. D. Brady for the State Geological Survey, and the proximate analysis published on page 205 of Vol. II, under No. 51.

A car load of coal from this mine was shipped to the Fuel Testing Plant of the U. S. Geological Survey at St. Louis, Mo. The results of the tests of this coal, as published on pages 206-208 of Bulletin No. 290 and pages 38-39 of Bulletin No. 325 of the U. S. G. Survey, are as follows:

"*West Virginia No. 15*.—Bituminous coal from Ocean mine, Fairmont Coal Company*, 3 miles east of Clarksburg, Harrison County, W. Va., on the Baltimore & Ohio Railroad.

"This sample consisted of run-of-mine coal and was loaded under the supervision of Inspector J. S. Burrows. It was used in making coking tests Nos. 36 and 43 and steaming tests Nos. 214, 215 and 216.

Two mine samples were taken for chemical analysis. No. 2039 was cut from the second butt entry off the third face entry, 2,750 feet northwest of the drift mouth. No. 2040 was cut in room 7 off the third butt entry, 2,025 feet northeast of the drift mouth.

---

*Now Consolidation Coal Co. and mine No. 68 on Map.—R. V. H.

Chemical Analyses.

		Mine samples		Car sample
	Laboratory number	2039	2040	2195
	Air-drying loss	1.50	1.90	0.90
Proximate	Moisture	2.80	3.27	2.01
	Volatile Matter	38.51	37.72	37.31
	Fixed Carbon	53.14	53.27	52.13
	Ash	5.55	5.74	8.55
	Sulphur	2.40	2.41	2.54
Ultimate	Hydrogen	....	....	5.08
	Carbon	....	....	75.83
	Nitrogen	....	....	1.43
	Oxygen	....	....	6.57
	Calorific value determined			
	Calories	7,836	....	7,673
	British thermal units	14,105	....	13,811

Steaming Tests.

"**Test 214, West Virginia No. 15.**—Size as shipped, run of mine. Size as used, over 1 inch, 33.1 per cent; ½ inch to 1 inch, 24.4 per cent; ¼ inch to ½ inch, 15 per cent; under ¼ inch, 27.5 per cent. Duration of test, 8.78 hours. Kind of grate, rocking.

"**Test 215, West Virginia No. 15.**—Size as shipped, run of mine. Size as used, over 1 inch, 32.6 per cent; ½ inch to 1 inch, 24.2 per cent; ¼ inch to ½ inch, 15.8 per cent; under ¼ inch, 27.4 per cent. Duration of test, 9.75 hours. Kind of grate, plain.

"**Test 216, West Virginia No. 15.**—Size as shipped, run of mine. Size as used, over 1 inch, 43.5 per cent; ½ inch to 1 inch, 20.3 per cent; ½ inch to ¼ inch, 14.5 per cent; under ¼ inch, 21.7 per cent. Duration of test, 5.80 hours. Kind of grate, plain.

Miscellaneous Items.

	Test 214	Test 215	Test 216
Heating value of coal—B. T. U. per pound dry coal	14,126	14,202	14,197
Force of draft:			
Under stack damper ..... inch water	0.53	0.40	0.41
Above fire ..... inch water	.22	.12	[a].04
Furnace temperature ..... °F	2,247	2,269	2,365
Dry coal used per square foot of grate surface per hour ..... pounds	16.32	16.77	21.28
Equivalent water evaporated per square foot of water-heating surface per hour ..... pounds	2.68	3.01	3.67
Percentage of rated horsepower of boiler developed	75.2	84.4	103.0
Water apparently evaporated per pound of coal as fired ..... pounds	7.65	7.44	7.14

	Test 214	Test 215	Test 216
Water evaporated from and at 212° F.:			
Per pound of coal as fired ....pounds	9.00	8.77	8.41
Per pound of dry coal..................pounds	9.18	8.99	8.65
Per pound of combustible.............pounds	10.92	10.04	9.63
Efficiency of boiler, including grate.....per cent	62.76	61.13	58.84
Coal as fired:			
Per indicated horsepower hour........pounds	3.14	3.22	3.36
Per electrical horsepower hour........pounds	3.88	3.98	4.15
Dry coal:			
Per indicated horsepower hour........pounds	3.08	3.15	3.27
Per electrical horsepower hour........pounds	3.80	3.88	4.04

Analyses.

	Test 214	Test 215	Test 216		Test 214	Test 215	Test 216
Proximate.				**Ultimate.**			
Moisture	1.90	2.47	2.73	Carbon[a]	77.45	77.93	77.90
Volatile Matter.	38.18	38.38	38.43	Hydrogen[a]	4.97	5.00	5.00
Fixed Carbon...	51.90	51.48	51.11	Oxygen[a]	4.87	4.90	4.89
Ash	8.02	7.67	7.73	Nitrogen[a]	1.46	1.47	1.47
	100.00	100.00	100.00	Sulphur	3.07	2.84	2.79
Sulphur	3.01	2.77	2.71	Ash	8.18	7.86	7.95
					100.00	100.00	100.00

[a] Figured from car sample.

Coking Tests.

"**Test 36, West Virginia No. 15.**—Size as shipped, run of mine. Size as used, finely crushed. Raw. Duration of test, 46 hours.

Coal charged.................................pounds..	10,000
Coke produced...............................pounds..	6,867
Breeze produced...........................pounds..	267
Coke produced.............................per cent..	68.67
Breeze produced..........................per cent..	2.76
Total percentage yield..........................	71.43

"**Remarks.**—Light gray and silvery. Good, heavy coke. High yield due to deposited carbon. Sulphur high.

"**Test 43, West Virginia No. 15.**—Size as shipped, run of mine. Size as used, finely crushed. Raw. Duration of test, 73 hours.

Coal charged...............................pounds..	12,000
Coke produced.............................pounds..	8,404
Breeze producer..........................pounds..	269
Coke produced..........................per cent..	70.03
Breeze produced.......................per cent..	2.24
Total percentage yield.........................	72.27

"**Remarks.**—Fine heavy coke. Silvery color. Breakage practically perfect; large pieces. Sulphur high. High yield due to deposited carbon.

---

[a] Forced draft.

Analyses.

	Test 36.		Test 43.	
	Coal.	Coke.	Coal.	Coke.
Moisture	1.79	0.45	2.33	0.26
Volatile Matter	37.90	.78	38.33	1.89
Fixed Carbon	53.00	88.70	51.72	87.30
Ash	7.31	10.07	7.62	10.55
Sulphur	2.73	2.09	2.72	2.26

"Virginia No. 4, West Virginia Nos. 14* and 15, and most of the Kansas coals clinker badly because the ash is low in proportion to the sulphur content—0.3 to 6 per cent of sulphur and 3.5 to 10 per cent of ash. When such coals are burned on a plain or a rocking grate, trouble with clinkers may generally be prevented by blowing steam under the grate. The usually assigned cause of this effect is that as the steam passes through the hot clinkers it is decomposed into hydrogen and oxygen. This decomposition is a cooling process and the heat needed to effect it is taken from the grate and the hot clinker, thus keeping the latter cool and preventing the fusing of the clinker into the grate.

"The use of steam to prevent the clinkers from melting into the grate was found to work satisfactorily with all the coals high in sulphur and ash. However, for coals very low in ash this method sometimes proved to be insufficient. In such cases crushed limestone spread over the thin, clean fire bed immediately on starting the test, prevented the clinkers from adhering to the grate, and was used for the second tests on West Virginia No. 14 and Virginia No. 4 coals. The cleaning of the fires after the first tests on these coals, when limestone was not used, took forty-five and thirty minutes, respectively. On the second tests, when limestone was used, the cleaning took eight and ten minutes, respectively.

"To make a general statement, it may be loosely said that the tendency of a coal to clinker varies directly with the sulphur (iron pyrites) and inversely with the ash in the coal."

Central Fairmont Coal Co., Snake Hill Mine.—No. 69 on Map.

Located 1 mile southeast of Clarksburg; **Pittsburgh coal.**

			Feet.	Inches.
1. Slate				
2. Coal, "head"	1′	2″		
3. Coal	2	6		
4. Bone	0	1¼		
5. Coal	4	11	8	8¼
6. Slate				

"Tidal elevation, 1075′, aneroid; owned by Hornor Davis; principal office, Clarksburg; daily capacity, 300 tons; 11 laborers and 45 miners employed; mule haulage; used for steam and domestic fuel; shipped east and west; butts, N. 77° W.; faces, N. 13° E.; greatest rise, southeast; recovery, 95 per cent; sample collected from Nos. 3 and 5 in Second Parallel by D. B. Reger; D. M. Harr, foreman, authority for data."

---

*Sample from Eagle coal of Page No. 1 of Loup Creek Colliery Co., Fayette Co., W. Va.—R. V. H.

For composition, calorific value and fuel ratio, see No. 69 in the table of coal analyses at the end of this chapter.

Vincent Coal Co., Graselli Mine.—No. 70 on Map.

Located on Moore run, 1.3 miles southeast of Clarksburg; **Pittsburgh coal.**

				Feet.	Inches.
1.	Slate				
2.	Coal, "head"	1'	9 "		
3.	Slate	0	0¼		
4.	Coal	0	10		
5.	Bone	0	0¼		
6.	Coal	0	8		
7.	Bone	0	1		
8.	Coal	3	5		
9.	Slate	0	0¾		
10.	Coal	1	6	8	4¼
11.	Slate				

"Tidal elevation, 1155', aneroid; owned by Kingwood Coal Co.; principal office, Clarksburg; daily capacity, 300 to 350 tons; 20 laborers and 40 miners employed; mule haulage; used for steam fuel and cement burning; shipped east; butts, N. 80° W.; faces, N. 10° E.; greatest rise, northeast; sample collected from Nos. 4, 5, 6, 8 and 10 in 3rd Left Heading by D. B. Reger; Vincent E. Gocke, Supt.; August Ricker, foreman, authority for data."

For composition, calorific value and fuel ratio, see No. 70 in the table of coal analyses at the end of this chapter.

Barnard Coal Co., Barnard Mine.—No. 71 on Map.

Located on Moore run, 0.7 mile northwest of Graselli; **Pittsburgh coal.**

		Feet.	Inches.
1.	Coal, thickness concealed		
2.	Coal	5	0
3.	Fire clay	5	0

"Tidal elevation, 1160', aneroid; owned by Wm. Burk; principal office, Clarksburg; 1 laborer and 2 miners employed; butts N. 80° W.; faces, N. 10° E.; greatest rise, southeast; sample collected from No. 2 of section by Ray V. Hennen. Just started to drive the heading and are in 100' (Oct. 18, 1910)."

For the composition, calorific value and fuel ratio, see No. 71 in the table of coal analyses at the end of this chapter.

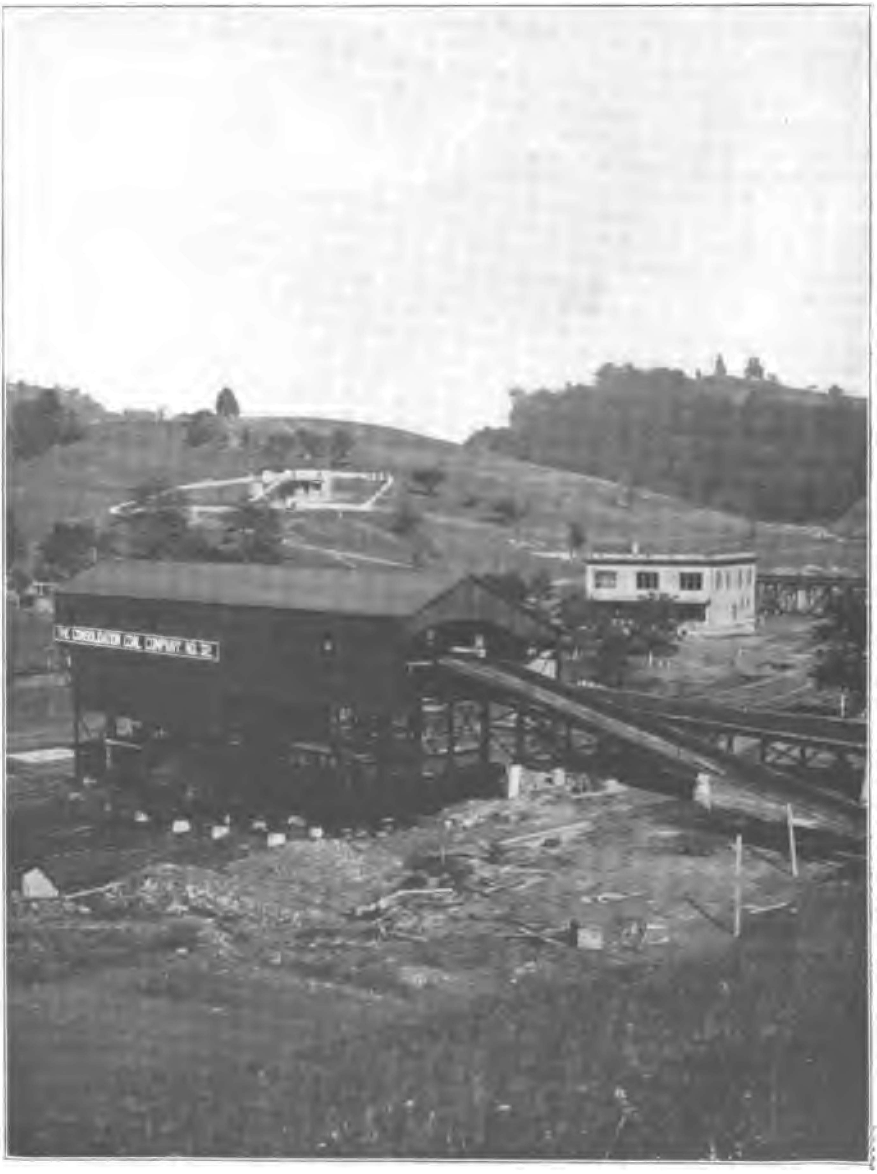


PLATE XX.—Steel Tipple at the Owings (No. 32) Mine of the Consolidation Coal Co. 2.5 miles S. E. of Shinnston—No. 25 on Map—Also Topography of the Monongahela series.

Harry B. Coal & Coke Co., Pitcairn Mine.—No. 72 on Map.

Located on Arnold run, 0.8 mile south of Clarksburg; **Pittsburgh coal.**

				Feet.	Inches.
1.	Coal, "head"	1'	0 "		
2.	Coal	0	8		
3.	Bone	0	0¼		
4.	Coal	0	4		
5.	Bone	0	1		
6.	Coal	0	8		
7.	Bone	0	0¼		
8.	Coal	5	5	8	2½
9.	Slate				

"Tidal elevation, 1085', aneroid; owned by Pitcairn Coal Co.; principal office, Fairmont; daily capacity, 1000 tons; 24 laborers and 92 miners employed; used for steam, gas and domestic fuel; shipped east and west; butts, N. 80° W.; faces, N. 10° E.; sample collected from Nos. 2, 4, 6 and 8 of section in Room No. 4 off 2nd Left off Main Headng, by D. D. Teets, Jr.; W. N. Russell, foreman, authority for data."

For the composition, calorific value and fuel ratio, see No. 72 in the table of coal analyses at the end of this chapter.

A car load of coal was shipped from this mine to the Fuel Testing Plant of the U. S. Geological Survey at St. Louis, Mo., for testing purposes, and the results obtained therefrom as published on pages 71, 82 and 127, respectively, of Bulletin No. 261 of the U. S. G. Survey, are as follows:

"*West Virginia No. 2.*—Run-of-mine coal from Pitcairn mine, Pitcairn Coal Company, Clarksburg, W. Va.

"Two coking tests were made on this sample, one of raw coal and one of washed coal. This affords an additional means of judging the effectiveness of washing, for the coke shows improvement in the second (washed coal) test, which can be accounted for only by better quality of coal. The following table shows the results:

Analyses Showing the Effect of Washing West Virginia No. 2 Coal.

	Coal.		Coke.	
	Raw	Washed.	From raw coal.	From washed coal.
Ash	8.22	7.05	14.95	11.40
Sulphur	3.38	2.84	3.40	2.24

Result of Coal Tests Under Boilers.

West Virginia No. 2 Coal.—Condition of sample, mine run, bright; chemical analysis:

Moisture	2.01 per cent.
Volatile Matter	39.23 per cent.
Fixed Carbon	48.80 per cent.
Ash	9.96 per cent.
	100.00 per cent.
Sulphur (separately determined)	2.71 per cent.

Duration of trial	10.22 hrs.
Total coal consumed	8354 lbs.
Horse power developed by boiler	212.2
Dry coal burned per sq. ft. of grate surface per hour	19.75 lbs.
Equivalent evaporation from and at 212° F. per pound of dry coal	9.14 lbs.
Dry coal per indicated horse power hour	3.09 lbs.
Dry coal per electrical horse power hour	3.82 lbs.

For other data as to tests of Pittsburgh coal from this mine, the reader is referred to Professional Paper No. 48 of the U. S. Geological Survey.

Coking Test.

"West Virginia No. 2.—Run-of-mine coal from Pitcairn mine of Pitcairn Coal Company, Clarksburg, W. Va.

"Two tests were made of this coal, unwashed and washed. The first charge was 9,000 pounds of unwashed coal, producing 5,235 pounds of gray coke, somewhat brittle and high in sulphur and ash. The washed coal, of which 13,000 pounds was charged, showed an improvement in the coke, though the sulphur was still too high for blast furnace use. The yield from the second charge was 7,808 pounds, or 60 per cent, as compared with 58.2 per cent from the unwashed coal."

The old **Dixie mine (No. 73 on map)** of the Consolidation Coal Co., located on Arnold run, 1.3 miles southwest of Clarksburg, had been abandoned in 1910, but it was once sampled for the State Geological Survey by S. D. Brady, and the proximate analysis, as published on page 206 of Vol. II, under No. 66, is given under No. 73 in the table of coal analyses at the end of this chapter.

Consolidation Coal Co. No. 46 (Lynch).—No. 74 on Map.

Located 2.5 miles south of Clarksburg, near mouth of Brown's run; **Pittsburgh coal.**

		Feet.	Inches.
1.	Coal, "head", thickness concealed		
2.	Coal	0'	6 "
3.	Bone	0	1
4.	Coal	0	6

				Feet.	Inches.
5.	Bone	0	1½		
6.	Coal	5	4	6	6½
7.	Slate				

"Tidal elevation, 1105′, aneroid; owned by Chas. P. Lynch; principal office, Fairmont; daily capacity, 30 tons; 3 laborers and 6 miners employed; mule haulage; used for steam, gas and domestic fuel; shipped east and west; sample collected from Nos. 2, 4 and 6 of section in chain pillar between No. 1 and No. 2, 3rd Left, by D. D. Teets, Jr.; U. A. Armour, foreman, authority for data."

For composition, calorific value and fuel ratio, see No. 74 in the table of coal analyses at the end of this chapter.

This mine was once sampled for the State Geological Survey by S. D. Brady, and the approximate analysis published on page 206 of Vol. II, under No. 67.

Consolidation Coal Co. No. 39 (Two Lick).—No. 75 on Map.

Located 0.8 mile due east of Lynch Mines; **Pittsburgh coal.**

				Feet.	Inches.
1.	Coal, "head"	0′	8 ″		
2.	Coal	0	4		
3.	Bone	0	0¼		
4.	Coal	0	3		
5.	Bone	0	1		
6.	Coal	0	5		
7.	Bone	0	1		
8.	Coal	4	4	6	2¼
9.	Slate				

"Tidal elevation, 1130′, aneroid; principal office, Fairmont; daily capacity, 300 tons; 17 laborers and 25 miners employed; used for steam, gas and domestic fuel; shipped east and west; butts, N. 80° W.; faces, N. 10° E.; greatest rise, southwest; sample collected from Nos. 2, 4, 6 and 8 of section in 2nd Right, 2nd North Face, by D. D. Teets, Jr.; I. L. Martin, assistant foreman, authority for data."

For composition, calorific value and fuel ratio, see No. 75 in the table of coal analyses at the end of this chapter.

This mine was once sampled by S. D. Brady for the State Geological Survey, and the approximate analysis published on page 206 of Vol. II, under No. 67.

Marshall Coal Co., Marshall Mine.—No. 76 on Map.

Located 1 mile northwest of Byron; **Pittsburgh coal.**

				Feet.	Inches.
1.	Coal, "head"	1′	3″		
2.	Coal	1	2		

				Feet.	Inches.
3.	Bone	0	2		
4.	Coal	1	4		
5.	Bone	0	5		
6.	Coal	3	2	7	6
7.	Slate				

"Tidal elevation, 1135′, aneroid; principal office, Philadelphia, Pa.; daily capacity, 600 tons; 30 laborers and 60 to 75 miners employed; rope haulage; used for steam, gas and domestic fuel; shipped east and west; butts, N. 78° W.; faces, N. 12° E.; greatest rise, west; sample collected from Nos. 2, 4 and 6 at pillar between main heading and empty roadway, by D. D. Teets, Jr.; S. R. Williams, Supt., authority for data."

For composition, calorific value and fuel ratio, see No. 76 in the table of coal analyses at the end of this chapter.

Byron Coal Co., Althea Mine.—No. 77 on Map.

Located ¾ mile northwest of Byron; Pittsburgh coal.

				Feet.	Inches.
1.	Coal, "head"	1′	1″		
2.	Coal	1	1		
3.	Bone	0	1		
4.	Coal	0	9		
5.	Bone	0	1		
6.	Coal	4	11	8	0
7.	Slate				

"Tidal elevation, 1140′, aneroid; owned by J. B. Smith; principal office, Clarksburg; daily capacity, 300 tons; 11 laborers and 32 miners employed; rope and mule haulage; used for steam and domestic fuel; shipped east and west; butts, N. 83° W.; faces, N. 7° E.; greatest rise, all directions; sample collected from Nos. 2, 4 and 6 of section in Room No. 1, 1st Left Butt heading by D. D. Teets, Jr.; I. Keith, Supt., authority for data."

For composition, calorific value and fuel ratio, see No. 77 in the table of coal analyses at the end of this chapter.

Consolidation Coal Company No. 60 (West Fork.)—No. 78 on Map.

Located ¼ mile northwest of Byron; Pittsburgh coal.

				Feet.	Inches.
1.	Coal, "head", thickness concealed				
2.	Coal	0′	2 ″		
3.	Bone	0	0¼		
4.	Coal	1	0		
5.	Bone	0	0½		
6.	Coal	0	4		
7.	Bone	0	0¾		
8.	Coal	4	9	6	4½

"Tidal elevation, 1104', spirit level; owned by Mt. Clare Coal Co.; principal office, Fairmont; daily capacity, 150 tons; 6 laborers and 10 miners employed; mule haulage; used for steam fuel on B. & O. R. R., local delivery; butts, east; faces, north; greatest rise, north; sample collected from Nos. 2, 3, 4, 5, 6 and 8 of section in Straight Heading by D. B. Reger; Lovell Childs, Supt.; J. M. Metheny, foreman, authority for data."

For the composition, calorific value and fuel ratio, see No. 78 in the table of coal analyses at the end of this chapter.

Daniel Coal Co., Gocke Mine.—No. 79 on Map.

Located ¼ mile due north of Byron; **Pittsburgh coal.**

				Feet.	Inches.
1.	Coal, "head"	0'	6"		
2.	Coal	0	6		
3.	Bone	0	1		
4.	Coal	0	10		
5.	Bone	0	0¼		
6.	Coal	5	0	6	11¼
7.	Slate				

"Tidal elevation, 1105', aneroid; owned by Stout and Reynolds; principal office, Clarksburg; daily capacity, 150 to 200 tons; 6 laborers and 23 miners employed; mule haulage; used for steam; shipped east and west; butts, N. 80° W.; faces, N. 10° E.; greatest rise, southwest; sample collected from Nos. 2, 4 and 6 of section by D. D. Teets, Jr.; H. S. Huber, Supt., authority for data."

For composition, calorific value and fuel ratio, see No. 79 in the table of coal analyses at the end of this chapter.

Hutchinson Coal Co., Byron Mine.—No. 80 on Map.

Located 0.6 mile southwest of Byron; **Pittsburgh coal.**

				Feet.	Inches.
1.	Coal, "head"	0'	10"		
2.	Coal	0	6		
3.	Bone	0	1		
4.	Coal	0	8		
5.	Bone	0	1		
6.	Coal	5	0	7	2
7.	Slate				

"Tidal elevation, 1125', aneroid; principal office, Fairmont; daily capacity, 1000 tons; 35 laborers and 50 miners employed; electric haulage; used for steam, gas and domestic fuel; shipped east and west; butts, N. 80° W.; faces, N. 10° E.; sample collected Oct. 31, 1910, from Nos. 2, 4 and 6 of section in 3rd West Heading by D. D. Teets, Jr.; mine superintendent is authority for data."

For composition, calorific value and fuel ratio, see No. 80 in table of coal analyses at the end of this chapter.

Consolidation Coal Co., No. 44. (Interstate No. 1).—No. 81 on Map.

Located 0.3 mile southeast of Byron; **Pittsburgh coal.**

				Feet.	Inches.
1.	Coal, "head"	1'	2 "		
2.	Coal	1	9½		
3.	Bone	0	1		
4.	Coal	0	3		
5.	Bone	0	0¾		
6.	Coal	5	1½	8	5¾
7.	Slate				

"Tidal elevation, 1170', spirit level; principal office, Fairmont; daily capacity, 50 tons; 2 laborers and 5 miners employed; mule haulage; used for steam, gas and domestic fuel; shipped east and west; butts, N. 80° W.; faces, N. 10° E.; greatest rise, southeast; sample collected from Nos. 2, 4 and 6 of section in Face Heading by D. D. Teets, Jr.; Guy Russell, foreman, authority for data."

For composition, calorific value and fuel ratio, see No. 81 in table of coal analyses at the end of this chapter.

This mine was once sampled for the State Geological Survey by S. D. Brady, and the proximate analysis published on page 206 of Vol. II, under No. 72.

Consolidation Coal Co. No. 64 (Interstate No. 2).—No. 82 on Map.

Located 1 mile southwest of Byron; **Pittsburgh coal.**

				Feet.	Inches.
1.	Coal, "head"	0'	10"		
2.	Coal	1	0		
3.	Bone	0	1		
4.	Coal	0	9		
5.	Bone	0	1		
6.	Coal	4	9	7	6
7.	Slate				

"Tidal elevation, 1150', aneroid; principal office, Fairmont; daily capacity, 300 tons; 15 laborers and 25 miners employed; mule haulage; used for steam, gas and domestic fuel; shipped east and west; butts, N. 80° W.; faces, N. 10° E.; greatest rise, southeast; sample collected from Nos. 2, 4 and 6 of section in Room No. 12, 2nd Left, off No. 2 South Face by D. D. Teets, Jr.; J. L. Thomas, foreman, authority for data."

For composition, calorific value and fuel ratio, see No. 82 in the table of coal analyses at the end of this chapter.

This mine was once sampled by S. D. Brady for the State Geol. Survey, and the proximate analysis published on page 206 of Vol. II, under No. 71.

Clarksburg Gas Coal Co., McWhorter Mine.—No. 84 on Map.

Located ¼ mile northwest of McWhorter; **Pittsburgh coal.**

				Feet.	Inches.
1.	Coal, "head"	0'	2 "		
2.	Coal	1	3		
3.	Bone	0	0⅛		
4.	Coal	0	7		
5.	Bone	0	0½		
6.	Coal	1	9½	3	10⅛
7.	Slate				

"Tidal elevation, 1350', aneroid; owned by McWhorter and McIntyre; principal office, Uniontown, Pa.; daily capacity, 500 tons; 15 laborers and 75 miners employed; electric haulage; used for steam, gas and domestic fuel; shipped east; butts, N. 80° W.; faces, N. 10° E.; greatest rise, northeast; sample collected from Nos. 2, 4 and 6 of section in main heading about 75' from outcrop (in water), by D. D. Teets, Jr.; Geo. S. Price, Supt., authority for data.

For the composition, calorific value and fuel ratio, see No. 84 in table of coal analyses at the end of this chapter. The section shows that a marked thinning has taken place in the Pittsburgh coal along the southern border of Harrison county. The sample was collected in water, according to Mr. Teets; hence, the high percentage of **moisture** reported in the analysis of the sample "as received," and the corresponding low calorific value and fuel ratio. The "air dried" result exhibits a better rating of the coal.

The **average analysis, calorific value and fuel ratio** of Pittsburgh coal from 66 mines in Harrison county are given in the table at the end of this chapter. A detailed study of this table will show that there is little variation, with one or two exceptions, from this average by the individual mines.

On pages 646-659 of Vol. II(A) of the State Geological reports, Mr. Frank Haas, formerly Chief Chemist, but now Consulting Engineer of the Consolidation Coal Company, gives a very interesting and valuable paper on the chemistry, quality and character of the Pittsburgh coal bed in Marion and Harrison counties, to which the reader is referred for comparative results.

Quantity of Pittsburgh Coal Available.

It is an easier matter to make an approximation of the available tonnage of Pittsburgh coal in Doddridge and Harrison counties than of any other bed in the area, as it is nearly always noted when present in the logs of the many oil and gas wells drilled therein, owing to its value as a "key rock" in determining depths to the several sands.

A description of the probable workable area of the Pittsburgh coal is given on pages 216 and 573, under the discussion of its stratigraphy and structure. Its crop in Harrison county is designated by an appropriate symbol on the economic geology map accompanying this report. The map also shows the **approximate western boundary line where the Pittsburgh coal bed of commercial thickness and purity disappears** in Doddridge county. The commercial area of the coal as thereon outlined has been determined by magisterial districts with a planimeter by Mr. Reger, the results of which are given in square miles in the table below. From a study of the several sections of this coal as exhibited in the foregoing commercial mines in Harrison, and the records of borings given in the table of wells for each county, the writer, in estimating the approximate available tonnage, feels safe in assuming a thickness of **6 feet** spread out over the areas designated in the following table. Figuring on the basis of 25 cubic feet to the short ton as with the Washington bed, page 567, the following results are obtained:

Table Showing Approximate Available Pittsburgh Coal.

Counties By Districts.	Sq. Miles.	Acres.	Cubic Feet of Coal.	Short Tons of Coal.
Doddridge				
McClellan	30.8	19,712	5,151,928,320	206,077,133
Grant	18.5	11,840	3,094,502,400	123,780,096
Cove	2.9	1,856	485,084,160	19,403,366
New Milton	7.0	4,480	1,170,892,800	46,835,712
Greenbrier	32.2	20,608	5,386,106,880	215,444,275
Totals	91.4	58,496	15,288,514,560	611,540,582
Harrison:				
Sardis	46.0	29,440	7,694,438,400	307,777,536
Ten Mile	50.6	32,384	8,463,882,240	338,555,290
Union	37.8	24,192	6,322,821,120	252,912,845
Eagle	36.5	23,360	6,105,369,600	244,214,784
Clay	27.3	17,472	4,566,481,920	182,659,277
Coal	14.0	8,960	2,341,785,600	93,671,424
Clark	8.7	5,568	1,455,252,480	58,210,099
Simpson	10.4	6,656	1,739,612,160	69,584,486
Grant	10.3	6,592	1,722,885,120	68,915,405
Elk	7.6	4,864	1,271,255,040	50,850,202
Total	249.2	159,488	41,683,783,680	1667,351,348
Total for both counties	340.6	217,984	56,972,298,240	2278,891,930

Of course, from the above estimate there would have to be subtracted 30 to 35 million tons, representing coal that has already been mined from this bed in Harrison, so that the total of Pittsburgh coal for the area would be reduced to **2,243,000,000** short tons.

COALS OF THE CONEMAUGH SERIES.

The Harlem Coal.

The Harlem coal appears to be the only bed of the Conemaugh series that attains sufficient thickness, purity and regularity in the Doddridge-Harrison area to be considered an economic resource. A full description of its chemical composition, calorific value, fuel ratio and distribution in the two counties is given on pages 256-261. Thereon it is shown that this coal attains a thickness of 10 to 30 inches in eastern Harrison, but appears to be absent in the western portion of the latter area, and in the whole of Doddridge. Where it crops to the surface along the crest of the Chestnut Ridge anticline in the eastern part of the former county, it has been mined by farmers for local domestic fuel, of which it furnishes a fair grade.

Quantity of Harlem Coal Available.

As near as can be ascertained from well records and exposures at crop, the Harlem coal is of minable thickness (15 to 30 inches) in that portion of Harrison county southeast of the straight line joining Boothsville with the intersection of Hackers creek with the Harrison-Lewis county line. This portion of the county covers an area of 135 square miles. However, Simpson and Elk creeks and their tributaries have eroded a considerable area—approximately 15 square miles—of this coal along the crest of the Chestnut Ridge arch; hence, the area of this bed of minable thickness, covers approximately **120 square miles.** In forming an estimate of available tonnage, the writer feels safe in assuming a thickness of **1 foot** spread out over the latter area. Figuring on the basis of 25 cubic feet to the short ton as heretofore, the following results are obtained:

Table Showing Approximate Available Harlem Coal.

	Sq. Miles	Acres	Cubic feet of Coal	Short Tons of Coal
Harrison County....	120	76,800	3,345,408,000	133,816,320

Of course, the Harlem coal could not be mined under present commercial conditions in competition with the thicker and purer seams easily available in the Appalachian field, but when the best coals become more expensive to win, then the former bed will constitute a reserve supply of fuel that will greatly prolong the life of the State's coal fields.

COALS OF THE ALLEGHENY SERIES.

The Upper Kittanning Coal.

According to the logs of the oil and gas well borings, the Upper Kittanning coal appears to be the only bed of the Allegheny series to attain minable thickness and persistence in the Doddridge-Harrison area, and its apparent minable area is seemingly confined to a narrow belt, 2 to 3 miles wide, extending southwestward across Harrison county from the Marion-Harrison county line at Boothsville to the Harrison-Lewis county line at McWhorter, via Bridgeport and Lost Creek. The coal belongs about 100 feet belows the base of the Conemaugh series; hence, it lies deeply below drainage at all points in the area under discussion, so that the only source of information availible as to its depth and thickness, with one exception, has been the very incomplete records of oil and gas wells. The exception mentioned is a coal test boring (690), located on the J. B. Sandusky farm on the north bank of Simpson creek, one mile southeastward from Bridgeport, and drilled by Payne and Brady of Clarksburg. This boring penetrated the Upper Kittanning horizon without finding merchantable coal.

The coal was recorded in the following list of wells scattered along the belt above outlined for its probable minable area:

Wells Recording Upper Kittanning Coal—Harrison County.

Map No.	NAME OF WELL	District	Elevation of Well Mouth Above Tide Feet	UPPER KITTANING COAL	
				Depth Feet	Thickness Feet
625	W. M. Gray No. 1	Clay	1385L	929	7
630	Nimshi Nuzum No. 4	Clay	1165B	726	4
633	R. L. Reed No. 1	Clay	954L	435	5
686	Jesse H. Willis No. 1	Simpson	1050B	470	11
688	Jesse H. Willis No. 3	Simpson	985L	350	6
708A	C. S. Gribble No. 1	Grant	1145B	430	5
716	John H. Hardway No. 1	Grant	1080B	380	6
732A	Bassell Heirs No. 1	Grant	......	335	3
734	H. Booth (Carr) No. 1	Elk	1010L	393	1
737	A. H. Davisson No. 1	Elk	1015B	310	4
	Average recorded thickness				5.2

Through the courtesy of W. A. Chambers of Bridgeport, Harrison county, the Survey was enabled to obtain samples for analysis of the Upper Kittanning and Lower Mercer? coals from the W. M. Gray No. 1 well (625), and the detailed record of the boring, published in connection with the Adamsville section, page 107. The composition, calorific value and fuel ratio of these coals, are given in the table of coal analyses at the end of this chapter. The Lower Mercer? coal, belonging in the Pottsville series of rocks, is thin and unimportant, but the analysis shows it to be comparatively low in sulphur.

Quantity of Upper Kittanning Coal Available.

As mentioned on preceding pages of this report, the records of oil and gas wells are very unreliable data as to the character and thickness of the coals penetrated, since the ordinary well driller, being interested only in getting down as soon as possible to the oil and gas horizons, does not exercise sufficient care to obtain the exact depth at which the top and bottom of a coal is reached, especially of the veins other than the Pittsburgh bed. Hence, the writer has a hesitancy in making even an approximate estimate on such meager information. If it should prove to be present over the area outlined above for eastern Harrison, say covering an area of 50 square miles and possessing an average thickness of 3 feet, then 167,270,000 short tons would have to be added to the available coal resources of the Doddridge-Harrison area.

Summary of Available Coal.

	Short Tons.
Washington coal	529,745,352
Uniontown coal	111,513,600
Redstone coal	70,811,136
Pittsburgh coal	2,243,000,000
Harlem coal	133,816,320
Grand total	3,088,886,408

The above estimate of available coal in the Doddridge-Harrison area does not mean that this amount will eventually be recovered. The percentage of recovery of a coal bed at present in West Virginia varies from 60 to 95 per cent of the mining section. Owing to the rapid progress in recent years in mining methods with regard to saving the largest possible amount of the bed, the writer is of the opinion that fully 80 per cent of the above estimate will be eventually mined. Figuring on this basis, the total available coal is reduced in round number to **2,471,000,000 short tons.**

MINABLE COALS BY MAGISTERIAL DISTRICTS.

In order to facilitate an investigation by the reader of data given in this report on the minable coals of the two counties, a brief summary of the same will now be given by magisterial districts.

Doddridge County.

McClellan District.—The Washington and Pittsburgh coals appear to be the only minable beds in McClellan district. The crop of the former is shown on the economic geology map accompanying this report. There still remains 57.4 square miles of this vein uneroded. Its thickness and character are discussed in the description of the geology of the Washington coal, pages 157-168. The same map shows that only the eastern portion of the district holds Pittsburgh coal of minable thickness, covering an area of 30.8 square miles. The map shows the tidal elevation of the latter seam at all points in the district. Its depth and thickness are exhibited in the table of wells for Doddridge county, pages 290-303. For the available tonnage of each bed, see pages 567 and 617 respectively.

Grant District.—The Washington, Uniontown and Pittsburgh coals appear to be the only minable beds in Grant district. The crop of the first is shown on the economic geology map accompanying this report, and its thickness, character and composition are discussed at length in Chapter V. There still remains an area uneroded of 35.3 square miles.

The Uniontown coal crops along the Baltimore & Ohio Railroad between Long Run station and the Grant-West Union district line, and northward from Morgansville along Morgans run to Harlin. A discussion of its thickness, character, composition, calorific value and fuel ratio is given in Chapter VI. Its available area is shown on a preceding page of this chapter.

The Pittsburgh coal lies deeply below drainage, but its depth and thickness are given in the table of wells for Doddridge county, under Nos. 88 to 138 inclusive. The western boundary line where this coal of commercial thickness and purity disappears in the district, is exhibited on the map above mentioned. No analyses of Pittsburgh coal were obtained in this district. The minable area of the bed has been approximated at 18.5 square miles. For the available tonnage of the Washington and Pittsburgh veins in the district, see pages 567 and 617, respectively.

West Union District.—The only minable coals in West Union district appear to be the Washington and Uniontown beds. A glance at the economic geology map accompanying this report will show that the district lies one mile westward from the western boundary line of the Pittsburgh coal as outlined thereon. The same map exhibits the crop of the Washington seam in detail. A discussion of the thickness, character, composition, calorific value and fuel ratio of the latter vein is given in Chapter V. The area of Washington coal left eroded is 24.3 square miles, and the estimated available coal in round numbers, 40,646,000 short tons.

A full discussion of the distribution, composition, calorific value and fuel ratio of the Uniontown coal is given in Chapter VI. Probably one-half of the available tonnage of this bed as estimated for the two counties on page 569, belongs in this district, or approximately 50,000,000 short tons. For ready comparison of the Washington and Uniontown beds, the reader is referred to the table of coal analyses at the end of this chapter.

Central District.—The Washington coal appears to be the only minable bed in Central district, a full discussion of the quality and character of which is given in Chapter V. The area of this coal left uneroded is 25 square miles, and the estimated available coal, 41,817,600 short tons.

It is barely possible that the Uniontown bed may be of minable thickness over the eastern portion of this district, but, if so, it was overlooked in the logs of several wells therein.

Southwest District.—The Washington coal appears to be the only minable bed in Southwest district. A glance at the economic geology map accompanying this report will show that it crops high in the hills therein, and for that reason only a small area—approximately 11 square miles—of this vein remains uneroded. It appears to be more irregular in this district than in any other in Doddridge county. A full discussion of its thickness, distribution, composition calorific value and fuel ratio is given in Chapter V. The estimate of available coal from this seam in Southwest district, is, in round numbers, 18,400,000 short tons.

Cove District.—The only minable coals in Cove district appear to be the Washington and Pittsburgh veins. A glance at the economic geology map accompanying this report, will show that over most of the district, the former coal crops high in the hills; hence, a large portion of its original area has been eroded, leaving approximately 19.7 square miles. A full discussion of its thickness, character and quality is given in Chapter V. The estimated available coal for the district, is, in round numbers, 32,950,000 short tons.

The minable area of Pittsburgh coal as outlined on the map above mentioned is confined to a narrow strip along the southeast border of the district, totaling 2.9 square miles. Of course, this western boundary line of commercial Pittsburgh coal is only approximate. The Albers and Fischer wells (248 and 250) record the coal, but do not give the thickness. The approximate available coal from this bed in the district has been estimated in round numbers at 19,400,000 short tons. For further details, see account of this bed in Chapter VI.

New Milton District.—The minable coals of New Milton district are the Washington, Uniontown and Pittsburgh beds. The thickness, character and quality of the Washington coal therein is discussed in Chapter V. The economic geology map of the two counties exhibits its crop in detail thereon. The area of the bed left uneroded is 36.3 square miles. The estimated available coal from this vein for the district, is, in round numbers, 60,700,000 short tons.

The minable area of the Uniontown coal is confined to the northern point of the district, covering about one-seventh of the total estimate of 50 square miles of this coal for Doddridge county, page 569; hence, the approximate available Uniontown coal for the district is, in round numbers, 15,900,000 short tons.

The minable area of the Pittsburgh bed in New Milton district, as limited on the map above mentioned, is confined to a narrow strip along the southeastern border. Its thickness therein is exhibited by the wells (275, 277 and 278) in the table for Doddridge county, page 300. The area of the coal as limited, totals 7 square miles. The estimated available coal, is in round numbers, 46,835,000 short tons. For a further description of this coal, see Chapter VI.

Greenbrier District.—The Washington and Pittsburgh coals appear to be the only minable beds in Greenbrier district. The crop of the former coal is shown in detail on the economic geology map accompanying this report, as well as the tidal elevation of the Pittsburgh vein at all points. The thickness, character and quality of the Washington coal is discussed in Chapter V. The amount of the coal left uneroded is 27.9 square miles. The approximate available Washington coal for the district, is, in round numbers, 46,668,000 short tons.

All but a narrow strip along the northwestern border of this district appears to be underlaid with minable Pittsburgh coal. As limited on the map above mentioned, the area of this coal totals 32.2 square miles. The approximate available Pittsburgh coal is, in round numbers 215,444,000 short tons. Its depth and thickness are given in the table of wells for Doddridge county under Nos. 278-317. For further information, see discussion of this coal in Chapter VI.

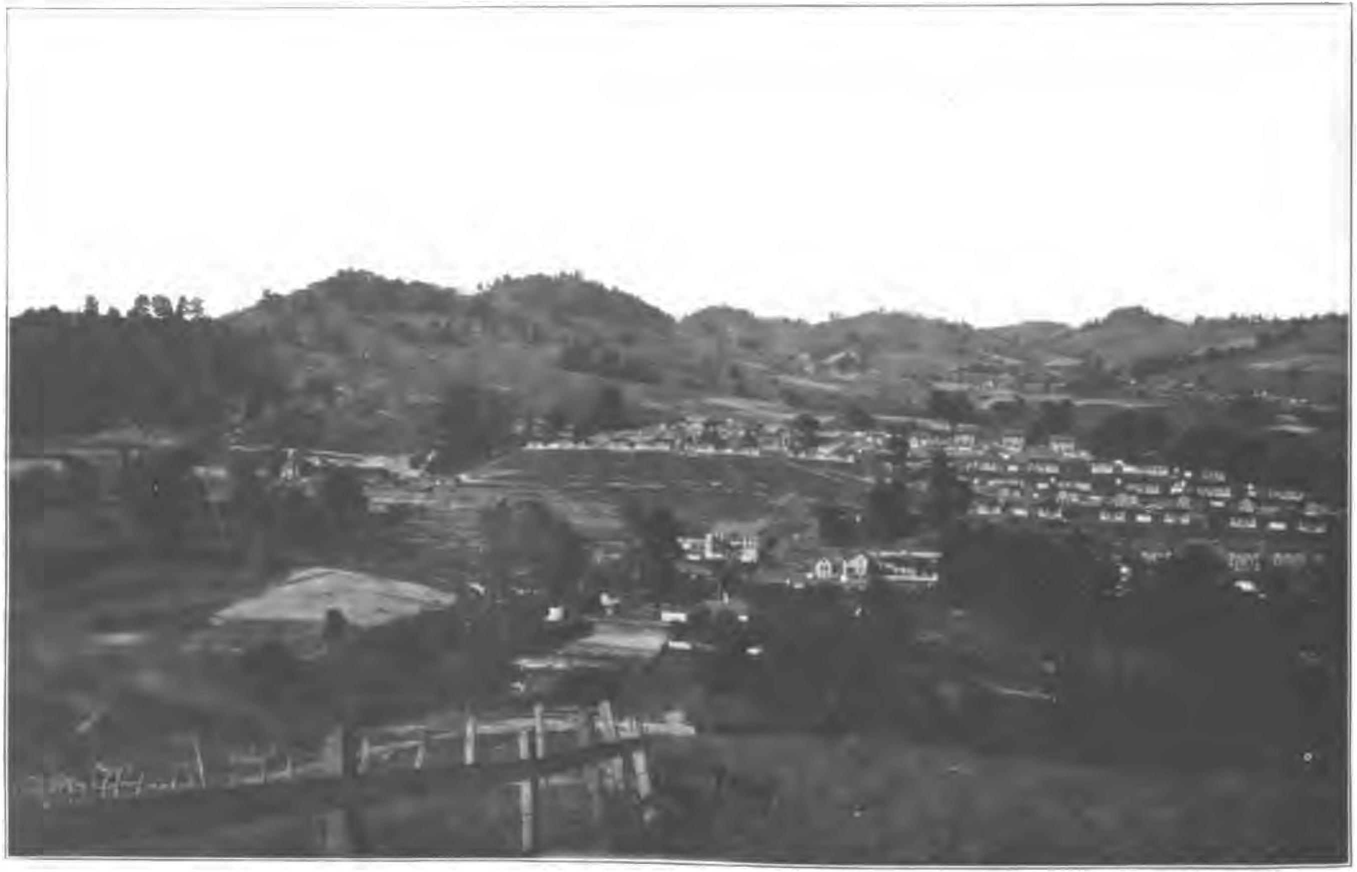


PLATE XXI.—Plant and Town at Enterprise (No. 49) Mine of the Consolidation Coal Co. at Enterprise—No. 13 on Map—Also Topography of the Monongahela series.

Harrison County.

Sardis District.—The only minable coals of Sardis district appear to be the Washington and Pittsburgh beds. A glance at the economic geology map accompanying this report, will show that both veins lie deeply buried below drainage along the axis of the Robinson syncline therein. The same map shows the crop of both coals in the eastern half of the district. The area of the Washington bed left uneroded is 31.2 square miles, and the approximate available Washington coal is, in round numbers, 52,188,000 short tons. For further information, see detailed discussion of this coal in Chapter V.

A detailed discussion of the character, thickness and quality of the Pittsburgh coal is given in both this chapter and in Chapter VI. The area of this bed left uneroded in the district is 46 square miles. The approximate available coal is, in round numbers, 307,775,000 short tons. Its depth and thickness is shown in the Harrison county table of wells under Nos. 318-395 inclusive. One commercial mine (No. 28 on map) in this coal occurs in Sardis, located 0.6 mile northwest of Dola, for data concerning which see No. 28 in the table of coal analyses at the end of this chapter.

Ten Mile District.—As in Sardis, the Washington and Pittsburgh coals are the only minable beds in Ten Mile District, and both lie deeply buried below drainage therein along the axis of the Robinson Basin. However, a glance at the economic geology map accompanying this report, will show that both crop in the eastern portion of the district, owing to the rapid rise of the strata in this direction on the western slope of the Wolf Summit anticline.

A full discussion of the thickness, quality and character of the Washington coal is given in this chapter and in Chapter V. The area of this bed left uneroded is 34.4 square miles, and the approximate available coal, in round numbers, 57,540,000 short tons.

A full discussion of the thickness, character and quality of the Pittsburgh coal is given in this chapter and in Chapter IX. The area of this coal left uneroded is 50.6 square miles, and the approximate available coal, in round numbers, 338,550,000 short tons. The depth and thickness of the coal are given in the Harrison county table of wells under Nos. 396-477 inclusive. There are no commercial mines in Ten Mile district.

Union District.—The Washington, Redstone and Pittsburgh coals appear to be only minable seams in Union district. The detailed crops of all three therein are shown on the economic geololgy map accompanying this report. The area of the Washington coal as thereon outlined is 6 square miles, and the approximate available coal, in round numbers, 10,000,000 short tons. For further information, see discussion of this coal in detail in Chapter V.

As shown on the map above mentioned, the minable area of the Redstone coal is confined to the southeastern portion of the district, totaling 3.8 square miles. The approximate available coal is, in round numbers, 21,185,000 short tons. A full discussion of its thickness, character and quality is given in this chapter and in Chapter VI.

The Pittsburgh coal crops high in the hills in the southeastern portion of Union district, so that its area is reduced to 37.8 square miles. The approximate available coal from this bed is, in round numbers, 252,900,000 short tons. No commercial mines occur therein. For special information as to its character and quality in the district, see No. 83 in the table of coal analyses at the end of this chapter. Its depth and thickness in several wells are given in the table for Harrison county under Nos. 478-531 inclusive. Other data on this coal are given in this chapter and in Chapter VI.

Eagle District.—The only minable coals of Eagle district appear to be the Washington and Pittsburgh beds, both of which are elevated above drainage therein by the Wolf Summit anticline. Their crop is indicated by appropriate symbols on the economic geology map accompanying this report. The thickness, quality and character of the Washington seam is discussed in detail in Chapter V. The area of this coal in Eagle as outlined on the map above mentioned is 8 square miles, and the approximate available coal, in round numbers, 13,380,000 short tons.

As mentioned above, the Pittsburgh coal rises above drainage in Eagle on the crest of the Wolf Summit Arch, and southeastward along West Fork river, so that the area left uneroded as outlined on the map referred to above is 36.5 square miles, and the approximate available coal, in round numbers, 244,200,000 short tons. In 1910 there were 13 commercial mines in this seam in the district, the same being represented both on the map and in the table of coal analyses at the end of this chapter by Nos. 20 and 21, 27 to 36 inclusive, and 39 to which the reader is referred for specific information as to the thickness, character and quality of the Pittsburgh coal at these mines. The accurate location of the mines along with page references for mine data, is given on the pages immediately following the table of coal analyses. For the depth and thickness of the coal in several wells in Eagle, see table of wells for Harrison county, under Nos. 532 to 599 inclusive. For further details, see discussion of this coal in Chapter VI.

Clay District.—The Washington, Pittsburgh, Harlem and Upper Kittanning coals all appear to be of minable thickness in Clay district. The crops of the Washington and Pittsburgh beds are indicated in detail on the economic geology map accompanying this report.

Owing to the high structural level of Clay, only a very small area of the Washington coal—0.2 square mile—remains uneroded, approximating, in round numbers, 330,000 short tons. For information as to the thickness, character and quality of the coal, see discussion of this bed in Chapter V.

The minable area of the Pittsburgh coal as outlined on the map referred to above is 27.3 square miles, and the approximate available coal, in round numbers, 182,660,000 short tons. In 1910 there were 16 commercial mines in this bed within the district, the same being represented both on the map referred to above and in the table of coal analyses at the end of this chapter by Nos. 12 to 19 inclusive, 22 to 26 inclusive, and 37 and 38, to which the reader is referred for specific information as to the thickness, character and quality of the coal at these mines. The accurate location of the mines along with page references for mine data is given on the pages immediately following the table of coal analyses. For the depth and thickness of the coal in several wells in Clay, see Nos. 600 to 649 inclusive in the table of wells for Harrison county. For further details, see discussion of the bed in Chapte VI.

As outlined on page 618, the minable area of Harlem coal in Clay is approximately confined to that portion southeast of a straight line through Boothsville and McAlpin, amounting to about 4 square miles, or one-thirtieth of the minable area estimated for Harrison county, approximating, in round numbers, 4,460,000 short tons. A discussion of its thickness, character and quality is given in Chapter VII. For comparative purposes the reader is referred to the data thereon under Nos. 87 to 91 inclusive in the table of coal analyses at the end of this chapter as well as the location of the openings and page references on the pages immediately following the latter table.

The apparent minable area of the Upper Kittanning coal in Clay is not well defined as this coal lies deeply below drainage at all points in the Doddridge-Harrison area. The reader is referred to the description of this bed under "Coals of the Allegheny Series" in this chapter.

Coal District.—The Pittsburgh coal appears to be the only minable seam in Coal district. The extreme eastern point of the latter area, however, may catch a few acres of minable Harlem and Upper Kittanning coals as the same are approximately outlined on pages 618 and 619 respectively. The detailed crop of the Pittsburgh bed is indicated on the economic geology map accompanyinig this report. The minable area as outlined thereon is 14 square miles, and the approximate available coal, in round numbers, 93,670,000 short tons. In 1910 there were 23 commercial mines in this seam within the district, the same being represented both on the map referred to above and in the table of coal analyses at the end of this chapter by Nos. 40, 42 to 52 inclusive, and 65 to 67 inclusive, to which the reader is referred for specific information as to the thickness, quality and character of the coal at these mines. The accurate location of the mines along with page references for mine data is given on the pages immediately following the table of coal analyses. See discussion of this coal in Chapter VI for further details. The depth and thickness of the seam at several wells are given in the Harrison county table of wells, under Nos. 650 to 668 inclusive.

Clark District.—The Pittsburgh, Harlem and Upper Kittanning coals appear to the only minable beds in Clark district, with considerable doubt attached to the latter seam. The crop of the Pittsburgh coal is given in detail on the economic geology map accompanying this report, and the area of the bed as outlined thereon is 8.7 square miles, giving the approximate available coal therefrom, in round numbers, 58,200,000 short tons. In 1910 there were 9 commercial mines in this coal within the district, represented both on the map above mentioned and in the table of coal analyses at the end of this chapter by Nos. 53, 62 to 64 inclusive, and 69 to 74 inclusive, to which the reader is referred for specific information as to the thickness, quality and character of the coal at these mines. The accurate location of the mines along with page references for mine data is given on the pages immediately following the table of coal analyses. For the structure and other data, see description of this coal in Chapter VI.

The minable area of the Harlem coal in this district, as outlined in the discussion of the seam in this chapter, is confined to a narrow strip along the southeast border. A full description of the thickness, quality and character of the coal is given in Chapter VII.

For data as to the minable area of the Upper Kittanning coal, see description of the bed in this chapter under "Coals of the Allegheny Series."

Simpson District.—The Redstone, Pittsburgh, Harlem and Upper Kittanning coals appear to be the only minable beds in Simpson district, with considerable doubt attached to the latter coal. The detailed crop of the Redstone where it has minable thickness is indicated by an appropriate symbol on the economic geology map accompanying this report, as well as the approximate northern boundary line where the bed of commercial thickness and purity disappears. The area of this seam in Simpson, as outlined on the latter map, is one square mile, and the approximate available coal, in round numbers, 5,575,000 short tons. A full discussion of the thickness, character and quality of the coal is given in Chapter VI.

The detailed crop of the Pittsburgh coal in Simpson is shown on the map mentioned above, and the area of the bed, as thereon outlined, is 10.4 square miles; hence, it has been eroded from much the greater portion of the district. The approximate available Pittsburgh coal is, in round numbers, 69,580,000 short tons. In 1910 there were only two commercial mines in this coal within the district, represented both on the map mentioned above and in the table of coal analyses at the end of this chapter by Nos. 41 and 68, to which the reader is referred for specific information as to the thickness, quality and character of the coal in these mines. For further details, see description of this seam in Chapter VI.

The probable minable areas of the Harlem and Upper Kittanning coals are sets forth in the descriptions of these beds on preceding pages of this chapter.

Grant District.—As in Simpson, the Redstone, Pittsburgh, Harlem andd Upper Kittanning coals appear to be the only minable beds in Grant district, with considerable doubt attached to the latter coal. Where the Redstone is of minable thickness in Grant, it is so designated at crop with an appropriate symbol on the economic geology map accompanying this report, as well as its northern boundary where the bed is of commercial thickness and purity. The area of the coal as outlined on this map in Grant is 3.5 square miles, and the approximate available coal, in round numbers, 19,510,000 short tons. In 1910 there were only 2 commercial mines in this coal within the district, represented both on the above mentioned map and in the table of coal analyses at the end of this chapter by Nos. 9 and 10, to which, in addition to Nos. 8 and 11, the reader is referred for specific information as to the thickness, quality and character of the coal. For further details, see description of the coal on a preceding page of this chapter.

The crop of the Pittsburgh coal in Grant is shown in detail on the map mentioned above, and the area of the bed as thereon outlined is 10.3 square miles, giving the approximate available coal, in round numbers, 68,900,000 short tons. In 1910 there were 9 commercial mines in this coal within the district, represented both on the map mentioned above and in the table of coal analyses at the end of this chapter by Nos. 75 to 83 inclusive, to which the reader is referred for details as to the thickness, quality and character of the coal in these mines. The accurate location of the mines along with page references for mine data is given on the pages immediately following the table of coal analyses. For further details, see account of this coal in Chapter VI.

The apparent minable areas of the Harlem and Upper Kittanning coals in Grant are outlined in the descriptions of these beds on preceding pages of this chapter, along with other data of interest.

Elk District.—As in Simpson and Grant, the Redstone, Pittsburgh, Harlem and Upper Kittanning coals appear to be the only minable beds in Elk district, with much doubt attached to the latter coal.

The crop of the Redstone where the coal is of minable thickness is shown by an appropriate symbol on the economic geology map accompanying this report, and the minable area as thereon outlined is 4.4 square miles, giving the approximate available coal, in round numbers, 24,500,000 short tons. There are no commercial mines within the district, but the same has been mined quite extensively therein by farmers for local domestic fuel, two of which are represented both on the map above mentioned and in the table of coal analyses at the end of this chapter by Nos. 6 and 7, to which the reader is referred for details as to the thickness, quality and character of the Redstone coal in Elk district. For further details as to this coal, see description of the bed on a preceding page of this chapter.

The detailed crop of the Pittsburgh coal in Elk is shown on the map mentioned above, and its area as thereon outlined is 7.6 square miles, giving the approximate available coal, in round numbers, 50,850,000 short tons. There are no commercial mines in this bed within the district, but detailed information as to its thickness and character therein are given on pages 575-576.

The apparent minable areas of the Harlem and Upper Kittanning coals in Elk are outlined in the description of these beds on preceding pages of this chapter, along with other interesting data.

COAL ANALYSES.

The following table gives the composition, calorific value and fuel ratio of the coals of the Doddridge-Harrison area. The coals have been arranged therein in descending order from the Washington bed of the Dunkard series down to what appears to be the Lower Mercer vein of the Pottsville measures. For explanations concerning the tabluated results, the reader is referred to pages 565 and 615 and to the author's preface:

ANALYSES OF COALS IN DODDRIDGE AND HARRISON COUNTIES.

(Under the heading "Condition of Sample" "A. D."=air dried, and "A. R."=as received).

Mine No. on Map.	Mine.	County.	Horizon.	Condition of Sample.	Proximate.				Common to both.		Ultimate.				Calorimeter B. T. U. for 1 lb. of coal.	Calculated B. T. U. for 1 lb. of coal.	Carbon divided by Oxygen + Ash
					Moisture.	Volatile Matter.	Fixed Carbon.	Phosphorus.	Ash.	Sulphur.	Carbon.	Hydrogen.	Oxygen.	Nitrogen.			
1	J. D. Benedum	Doddridge	Washington	A. R.	1.58	33.82	51.83	0.011	12.77	3.51	68.83	4.81	9.08	1.00	12488	12435	3.
2	R. M. Orr	Doddridge	Washington	A. R.	1.66	34.36	46.32	0.076	17.66	2.50	63.95	4.53	10.25	1.11	11712	11418	2.
3	D. H. Nicholson	Doddridge	Washington U. Bench	A. R.	1.69	36.48	49.20	0.077	12.63	3.95	68.38	4.68	9.39	0.97	12485	12282	3.1
3	D. H. Nicholson	Doddridge	Washington L. Bench	A. R.	1.44	36.96	49.66	0.018	11.94	3.64	68.02	4.67	10.75	0.98	12542	12105	2.9
	Average	Doddridge	Washington	A. R.	1.59	35.41	49.50	0.046	13.75	3.40	67.30	4.67	9.87	1.02	12307	12060	2.8
4	W. A. Stutler	Doddridge	Uniontown	A. R.	1.67	38.73	45.27	0.041	14.33	4.77	66.79	4.80	8.39	0.92	12349	12239	2.9
5	Alfred C. Collins	Doddridge	Uniontown	A. R.	1.60	39.99	45.31	0.040	13.10	4.65	67.59	4.65	9.02	0.99	12464	12208	3.0
	Average	Doddridge	Uniontown	A. R.	1.64	39.36	45.29	0.041	13.72	4.71	67.19	4.73	8.71	0.96	12407	12224	3.0
6	L. P. Loudin	Harrison	Redstone, U. Bench	A. R.	0.91	35.24	59.02	0.004	4.83	1.61	79.96	5.27	7.35	0.98	14088	14392	6.5
6	L. P. Loudin	Harrison	Redstone, Cannel	A. R.	0.88	32.32	44.30	0.039	22.50	2.78	64.50	3.69	5.31	1.22	11396	11373	2.3
7	Gary Harris	Harrison	Redstone	A. R.	0.76	39.03	55.34	0.020	4.87	2.82	77.27	5.20	8.77	1.07	13991	13901	5.6
8	James McIntyre	Harrison	Redstone	A. R.	1.40	35.57	58.72	0.018	4.31	1.01	79.15	4.96	9.43	1.14	14199	13897	5.7
9	Clarksburg Gas Coal Co.	Harrison	Redstone	A. D.	1.15	36.81	55.93	0.017	6.11	1.07	81.87	3.89	5.88	1.18	14044	13912	6.8
10	High Grade Coal Co.	Harrison	Redstone	A. D.	1.28	37.57	54.45	0.019	6.70	3.06	75.15	5.26	8.70	1.13	13643	13640	4.8
10	High Grade Coal Co.	Harrison	Redstone	A. R.	1.28	37.57	54.45	0.019	6.70	3.06	75.15	5.26	8.70	1.13	13643	13640	4.8
11	Kroger Gale Coal Co.	Lewis	Redstone	A. D.	1.47	34.18	60.08	0.025	4.27	1.04	78.48	5.39	9.64	1.18	14110	14055	5.6
11	Kroger Gale Coal Co.	Lewis	Redstone	A. R.	2.48	33.83	59.46	0.025	4.25	1.03	77.68	5.45	10.44	1.17	13967	13912	5.2
	Average		Redstone	A. D.	1.30	36.19	56.82	0.020	5.69	1.72	78.50	4.85	8.07	1.16	13932	13869	5.7
	Average		Redstone	A. R.	1.37	36.25	57.40	0.017	4.99	1.91	77.84	5.23	8.94	1.10	13978	13948	5.
12	Marion Gas Coal Co.	Harrison	Pittsburgh	A. D.	0.68	38.38	54.80	0.021	6.14	2.24	77.09	5.17	8.13	1.23	14065	13883	5.4
12	Marion Gas Coal Co.	Harrison	Pittsburgh	A. R.	1.54	38.08	54.33	0.021	6.08	2.22	76.42	5.22	8.84	1.22	13943	13762	5.1
13	Cons. No. 49 (Enterprise)	Harrison	Pittsburgh	A. D.	0.98	36.36	54.76	0.011	7.90	3.12	76.59	4.81	6.24	1.34	13749	13765	5.4
13	Cons. No. 49 (Enterprise)	Harrison	Pittsburgh	A. R.	1.79	36.06	54.31	0.011	7.84	3.09	75.96	4.86	6.93	1.32	13636	13652	5.1
	Monongah Fuel Co.	Harrison	Pittsburgh	A. D.	0.75	37.83	54.52	0.011	6.90	2.02	78.75	5.04	6.90	1.17	14148	14190	5.7

ANALYSES OF COALS IN DODDRIDGE AND HARRISON COUNTIES.

(Under the heading "Condition of Sample" "A. D."=air dried, and "A. R."=as received).

Mine No. on Map	Mine.	County.	Horizon.	Condition of Sample	Proximate.				Common to both.		Ultimate.				Calorimeter B. T. U. for 1 lb. of coal.	Calculated B. T. U. for 1 lb. of coal.	Carbon divided by Oxygen + Ash.
					Moisture.	Volatile Matter.	Fixed Carbon.	Phosphorus.	Ash.	Sulphur.	Carbon.	Hydrogen.	Oxygen.	Nitrogen.			
13A	Monongah Fuel Co.	Harrison	Pittsburgh	A. R.	1.52	37.54	54.09	0.011	6.85	2.00	78.14	5.09	6.76	1.16	14038	14079	5.74
14	Cons. No. 40 (Viropa)	Harrison	Pittsburgh	A. D.	0.72	36.56	55.58	0.033	7.14	2.50	76.01	5.20	7.81	1.34	14021	13773	5.09
14	Cons. No. 40 (Viropa)	Harrison	Pittsburgh	A. R.	1.40	36.31	55.20	0.033	7.09	2.48	75.50	5.24	8.36	1.33	13927	13679	4.89
15	Cons. No. 66 (Riverdale)	Harrison	Pittsburgh	A. D.	0.78	36.62	55.93	0.031	6.67	1.62	76.99	5.27	8.11	1.34	13930	13904	5.21
15	Cons. No. 66 (Riverdale)	Harrison	Pittsburgh	A. R.	1.31	36.43	55.63	0.031	6.63	1.61	76.58	5.30	8.55	1.33	13856	13830	5.04
16	Cons. No. 65 (Solon)	Harrison	Pittsburgh	A. D.	0.79	35.54	57.44	0.021	6.23	0.87	77.81	5.03	8.60	1.46	13927	13808	5.24
16	Cons. No. 65 (Solon)	Harrison	Pittsburgh	A. R.	2.27	35.01	56.58	0.021	6.14	0.86	76.65	5.12	9.80	1.43	13719	13602	4.81
17	Cons. No. 51 (Ehlen)	Harrison	Pittsburgh	A. D.	0.71	37.20	54.56	0.017	7.53	2.72	74.79	4.92	8.71	1.33	13664	13363	4.61
17	Cons. No. 51 (Ehlen)	Harrison	Pittsburgh	A. R.	2.11	36.68	53.79	0.017	7.42	2.68	73.74	5.00	9.85	1.31	13471	13175	4.27
18	Cons. No. 42 (Robinson Run)	Harrison	Pittsburgh	A. D.	0.70	39.16	52.21	0.019	7.93	3.67	75.55	4.89	6.96	1.00	13650	13628	5.07
18	Cons. No. 42 (Robinson Run)	Harrison	Pittsburgh	A. R.	1.12	39.00	51.98	0.019	7.90	3.66	75.23	4.92	7.29	1.00	13593	13575	4.95
19	Haywood Coal Mining Co.	Harrison	Pittsburgh	A. D.	1.04	39.63	51.85	0.031	7.48	3.47	75.16	4.96	7.69	1.24	13786	13553	4.95
19	Haywood Coal Mining Co.	Harrison	Pittsburgh	A. R.	2.11	39.20	51.29	0.031	7.40	3.43	74.34	5.03	8.58	1.22	13636	13406	4.65
20	Cons. No. 36 (Lucas)	Harrison	Pittsburgh	A. D.	0.63	40.37	51.10	0.014	7.90	4.25	75.57	4.98	6.05	1.25	13642	13786	5.42
20	Cons. No. 36 (Lucas)	Harrison	Pittsburgh	A. R.	0.87	40.28	50.97	0.014	7.88	4.24	75.39	5.00	6.24	1.25	13608	13754	5.34
21	Cons. No. 54 (Pooz)	Harrison	Pittsburgh	A. D.	0.79	40.45	52.29	0.012	6.47	3.63	75.89	4.81	7.87	1.33	13790	13558	5.29
21	Cons. No. 54 (Pooz)	Harrison	Pittsburgh	A. R.	1.67	40.09	51.83	0.012	6.41	3.60	75.21	4.86	8.60	1.32	13667	13438	5.01
22	Va. and Md Coal Corp. (Willard No. 2)	Harrison	Pittsburgh	A. D.	0.85	38.15	55.61	0.038	5.39	2.21	77.70	5.13	8.21	1.36	14102	13940	5.71
22	Va. and Md Coal Corp. (Willard No. 2)	Harrison	Pittsburgh	A. R.	1.84	37.77	55.06	0.038	5.33	2.19	76.93	5.18	9.03	1.34	13961	13801	5.36
23	Va. and Md. Coal Corp. (Willard No. 1)	Harrison	Pittsburgh	A. D.	0.93	36.89	56.11	0.031	6.07	1.99	78.44	4.89	7.22	1.39	14146	13963	5.90
23	Va. and Md. Coal Corp. (Willard No. 1)	Harrison	Pittsburgh	A. R.	1.92	36.52	55.55	0.031	6.01	1.97	77.68	4.95	8.03	1.38	14006	13826	5.53
24	Cons. No. 61 (Owings)	Harrison	Pittsburgh	A. D.	0.65	35.08	59.38	0.026	4.89	1.06	79.84	5.03	7.77	1.41	14232	14173	6.31
24	Cons. No. 61 (Owings)	Harrison	Pittsburgh	A. R.	2.17	34.54	58.47	0.026	4.82	1.04	78.62	5.12	9.01	1.39	14014	13956	5.68

ANALYSES OF COALS IN DODDRIDGE AND HARRISON COUNTIES.

(Under the heading "Condition of Sample" "A. D."=air dried, and "A. R."=as received).

Mine No. on Map.	Mine.	County.	Horizon.	Condition of Sample.	Proximate.				Common to both.		Ultimate.				Calorimeter B. T. U. for 1 lb. of coal.	Calculated B. T. U. for 1 lb. of coal.	Carbon divided by Oxygen + Ash.
					Moisture.	Volatile Matter.	Fixed Carbon.	Phosphorus.	Ash.	Sulphur.	Carbon.	Hydrogen.	Oxygen.	Nitrogen.			
24	Cons. No. 61 (Head coal)	Harrison	Pittsburgh	A. D.	0.44	39.24	54.83	0.211	5.49	0.88	80.15	5.09	6.97	1.42	14241	14310	6.43
24	Cons. No. 61 (Head coal)	Harrison	Pittsburgh	A. R.	1.77	38.72	54.10	0.211	5.41	0.87	79.07	5.17	8.08	1.40	14050	14118	5.86
25	Cons. No. 32 (Owings)	Harrison	Pittsburgh	A. D.	0.81	36.37	57.68	0.017	5.14	0.81	78.41	5.31	8.87	1.39	14342	14051	5.60
25	Cons. No. 32 (Owings)	Harrison	Pittsburgh	A. R.	1.86	35.99	57.06	0.017	5.09	0.88	77.58	5.09	9.70	1.38	14190	13902	5.25
26	J. R. Bartlett	Harrison	Pittsburgh	A. R.	0.93	36.98	57.99	0.004	4.10	1.47	79.77	5.10	8.50	1.06	14218	14168	6.33
27	Short Line Coal Co. (Girard No. 2, new opening)	Harrison	Pittsburgh	A. D.	0.33	41.59	51.22	0.015	6.86	3.48	76.58	4.81	6.93	1.34	13835	13723	5.55
27	Short Line Coal Co. (Girard No. 2, new opening)	Harrison	Pittsburgh	A. R.	1.52	41.09	50.61	0.015	6.78	3.44	75.66	4.88	7.92	1.32	13669	13559	5.15
28	Short Line Coal Co. (Girard No. 2, old opening)	Harrison	Pittsburgh	A. D.	0.54	41.74	50.66	0.015	7.06	3.61	76.46	4.79	6.92	1.16	13693	13702	5.47
28	Short Line Coal Co. (Girard No. 2, old opening)	Harrison	Pittsburgh	A. R.	1.65	41.27	50.10	0.015	6.98	3.57	75.60	4.85	7.85	1.15	13539	13549	5.10
29	Fayette Coal Co.	Harrison	Pittsburgh	A. D.	1.24	38.92	53.86	0.005	5.98	2.75	77.17	5.19	7.68	1.23	13871	13958	5.65
29	Fayette Coal Co.	Harrison	Pittsburgh	A. R.	2.54	38.41	53.15	0.005	5.90	2.71	76.16	5.27	8.75	1.21	13689	13774	5.20
30	National Coal Co.	Harrison	Pittsburgh	A. D.	1.00	40.72	51.84	0.004	6.44	3.15	76.11	4.99	8.15	1.16	13938	13659	5.22
30	National Coal Co.	Harrison	Pittsburgh	A. R.	1.90	40.35	51.37	0.004	6.38	3.12	75.42	5.04	8.89	1.15	13811	13535	4.94
31	Swiger Coal Co.	Harrison	Pittsburgh	A. D.	1.07	40.70	52.09	0.004	6.14	2.66	77.24	4.97	7.79	1.20	13891	13822	5.54
31	Swiger Coal Co.	Harrison	Pittsburgh	A. R.	2.12	40.27	51.53	0.004	6.08	2.63	76.42	5.04	8.65	1.18	13742	13674	5.18
32	Peacock Coal Co.	Harrison	Pittsburgh	A. D.	0.98	39.02	52.50	0.010	7.50	3.79	76.25	4.72	6.60	1.14	13649	13656	5.41
32	Peacock Coal Co.	Harrison	Pittsburgh	A. R.	1.57	38.79	52.19	0.010	7.45	3.77	75.79	4.75	7.10	1.14	13567	13574	5.21
33	Rosebud Fuel Co.	Harrison	Pittsburgh	A. D.	0.98	39.30	52.42	0.010	7.30	3.27	77.14	4.85	6.15	1.29	13737	13881	5.74
33	Rosebud Fuel Co.	Harrison	Pittsburgh	A. R.	1.47	39.11	52.16	0.010	7.26	3.25	76.77	4.88	6.55	1.29	13669	13813	5.56
34	Lumberport Steam Coal Co.	Harrison	Pittsburgh	A. D.	1.18	39.12	53.70	0.014	6.00	2.49	77.77	5.06	7.42	1.26	13944	13980	5.80
34	Lumberport Steam Coal Co.	Harrison	Pittsburgh	A. R.	2.07	38.76	53.22	0.014	5.95	2.47	77.07	5.12	8.15	1.24	13818	13854	5.47
35	Blue Ridge Coal Co.	Harrison	Pittsburgh	A. D.	0.61	39.41	53.00	0.043	6.98	3.34	76.02	4.59	7.86	1.21	13761	13431	5.12
35	Blue Ridge Coal Co.	Harrison	Pittsburgh	A. R.	1.39	39.10	52.58	0.043	6.93	3.31	75.42	4.63	8.51	1.20	13653	13335	4.88

ANALYSES OF COALS IN DODDRIDGE AND HARRISON COUNTIES.

(Under the heading "Condition of Sample" "A. D."=air dried, and "A. R."=as received).

Mine No. on Map.	Mine.	County.		Condition of Sample.	Proximate.				Common to both		Ultimate.				Calorimeter B. T. U. for 1 lb. of coal.	Calculated B. T. U. for 1 lb. of coal.	Carbon divided by Oxygen + Ash.
					Moisture.	Volatile Matter.	Fixed Carbon.	Phosphorus.	Ash.	Sulphur.	Carbon.	Hydrogen.	Oxygen.	Nitrogen.			
36	Hero Coal and Coke Co......	Harrison .	Pittsburgh	A. D.	0.72	39.37	52.11	0.018	7.80	3.54	76.26	4.92	6.45	1.03	13671	13790	5.35
36	Hero Coal and Coke Co......	Harrison .	Pittsburgh	A. R.	0.81	39.33	52.06	0.018	7.80	3.54	76.19	4.93	6.51	1.03	13661	13778	5.32
37	Cons. No. 21 (Gypsy)........	Harrison .	Pittsburgh	A. D.	0.82	39.07	52.75	0.023	7.36	3.35	75.45	5.20	7.31	1.33	13823	13770	5.14
37	Cons. No. 21 (Gypsy)........	Harrison .	Pittsburgh	A. R.	2.49	38.41	51.86	0.023	7.24	3.29	74.19	5.29	8.68	1.31	13591	13539	4.66
38	Cons. (Maulsby).............	Harrison .	Pittsburgh		0.83	38.64	55.04	0.017	5.49	2.13					14213		
39	Lambert Run Coal Co.......	Harrison .	Pittsburgh	A. D.	0.88	39.29	53.63	0.006	6.20	2.46	76.66	4.95	8.55	1.20	13825	13655	5.20
39	Lambert Run Coal Co.......	Harrison .	Pittsburgh	A. R.	1.41	39.08	53.35	0.006	6.16	2.45	76.25	4.98	8.96	1.20	13752	13583	5.04
40	Cons. No. 55 (Meadowbrook)..	Harrison .	Pittsburgh	A. D.	0.25	38.35	54.45	0.014	6.95	3.05	77.43	5.01	6.35	1.21	13930	14002	5.82
40	Cons. No. 55 (Meadowbrook)..	Harrison .	Pittsburgh	A. R.	0.88	38.11	54.10	0.014	6.91	3.03	76.94	5.04	6.88	1.20	13842	13914	5.58
40	Cons. No. 55 (head coal)....	Harrison .	Pittsburgh	A. D.	0.40	35.90	52.12	0.148	11.58	3.31	73.25	4.62	6.01	1.23	13139	13188	4.16
40	Cons. No. 55 (head coal)....	Harrison .	Pittsburgh	A. R.	0.79	35.76	51.92	0.148	11.53	3.30	72.97	4.64	6.34	1.22	13088	13137	4.08
41	Cook Coal & Coke Co. (Girard No. 1)................	Harrison .	Pittsburgh	A. D.	1.03	38.57	54.67	0.015	5.73	1.47	78.27	5.03	8.12	1.38	13984	13936	5.65
41	Cook Coal & Coke Co. (Girard No. 1)................	Harrison .	Pittsburgh	A. R.	2.38	38.04	53.93	0.015	5.65	1.45	77.21	5.11	9.22	1.36	13798	13747	5.19
42	Harrison County Coal Co.....	Harrison .	Pittsburgh	A. D.	0.90	39.62	53.55	0.004	5.93	2.45	76.76	4.81	8.84	1.21	13725	13564	5.19
42	Harrison County Coal Co.....	Harrison .	Pittsburgh	A. R.	1.32	39.45	53.33	0.004	5.90	2.44	76.44	4.84	9.17	1.21	13665	13507	5.07
43	Hutchinson Coal Co. (Erie)..	Harrison .	Pittsburgh	A. D.	0.93	39.13	53.32	0.043	6.22	3.48	76.12	4.97	7.57	1.24	14061	13712	5.52
43	Hutchinson Coal Co. (Erie)..	Harrison .	Pittsburgh	A. R.	1.52	38.90	53.00	0.043	6.58	3.46	75.68	5.00	8.05	1.23	13978	13631	5.17
44	Cons. No. 33 (Globe).........	Harrison .	Pittsburgh	A. D.	0.54	37.09	56.52	0.008	5.85	2.43	77.14	5.22	8.07	1.29	14028	13929	5.54
44	Cons. No. 33 (Globe).........	Harrison .	Pittsburgh	A. R.	1.55	36.72	55.94	0.008	5.79	2.41	76.35	5.27	8.90	1.28	13885	13787	5.20
45	Cons. (Glen Falls)...........	Harrison .	Pittsburgh		0.99	39.33	54.06	0.016	5.62	2.48							
46	Cons. No. 27 (Dunham)......	Harrison .	Pittsburgh	A. D.	0.60	39.30	54.61	0.023	5.49	3.08	78.03	4.90	7.27	1.23	14023	13948	6.12
46	Cons. No. 27 (Dunham)......	Harrison .	Pittsburgh	A. R.	1.54	38.93	54.09	0.023	5.44	3.05	77.30	4.95	8.04	1.22	13891	13817	5.73
47	Cons. No. 48 (Falls Run).....	Harrison .	Pittsburgh	A. D.	0.60	38.63	54.40	0.029	6.37	2.29	78.30	4.63	7.18	1.23	13970	13800	5.78
47	Cons. No. 48 (Falls Run).....	Harrison .	Pittsburgh	A. R.	1.36	38.34	53.98	0.029	6.32	2.27	77.70	4.68	7.81	1.22	13864	13696	5.50
48	Cons. No. 62 (Perry No. 3)...	Harrison .	Pittsburgh	A. D.	0.73	42.62	48.23	0.021	8.42	4.27	74.52	4.94	6.82	1.03	13619	13548	4.89

ANALYSES OF COALS IN DODDRIDGE AND HARRISON COUNTIES.

(Under the heading "Condition of Sample" "A. D."=air dried, and "A. R."=as received).

Mine No. on Map	Mine.	County.	Horizon.	Condition of Sample.	Proximate.				Common to both.		Ultimate.				Calorimeter B. T. U. for 1 lb. of coal.	Calculated B. T. U. for 1 lb. of coal.	Carbon divided by Oxygen + Ash.
					Moisture.	Volatile Matter.	Fixed Carbon.	Phosphorus.	Ash.	Sulphur.	Carbon.	Hydrogen.	Oxygen.	Nitrogen.			
48	Cons. No. 62 (Perry No. 3)	Harrison	Pittsburgh	A. R.	1.12	42.45	48.08	0.021	8.39	4.25	74.23	4.96	7.15	1.02	13566	13495	4.78
49	Corona Coal & Coke Co.	Harrison	Pittsburgh	A. D.	0.73	37.62	53.62	0.019	8.03	3.82	74.36	4.56	8.02	1.21	13543	13178	4.63
49	Corona Coal & Coke Co.	Harrison	Pittsburgh	A. R.	1.59	37.70	53.16	0.019	7.95	3.79	73.72	4.61	8.73	1.20	13426	13064	4.42
50	Chas. T. Moore	Harrison	Pittsburgh	A. D.	0.86	40.50	52.23	0.005	6.41	2.91	76.68	5.32	7.60	1.08	14000	13981	5.47
50	Chas. T. Moore	Harrison	Pittsburgh	A. R.	1.71	40.16	51.78	0.005	6.35	2.89	76.02	5.36	8.31	1.07	13879	13861	5.19
51	O'Gara Coal Co.	Harrison	Pittsburgh	A. D.	0.92	40.74	51.45	0.006	6.89	3.61	77.22	5.10	6.09	1.09	14241	14069	5.95
51	O'Gara Coal Co.	Harrison	Pittsburgh	A. R.	1.43	40.53	51.19	0.006	6.85	3.59	76.83	5.13	6.51	1.09	14169	13997	5.75
52	Hutchinson Coal Co. (Delta)	Harrison	Pittsburgh	A. D.	1.00	39.72	51.60	0.004	7.68	3.73	74.29	5.04	8.17	1.09	13941	13449	4.69
52	Hutchinson Coal Co. (Delta)	Harrison	Pittsburgh	A. R.	1.57	39.49	51.30	0.004	7.64	3.71	73.86	5.07	8.64	1.08	13860	13371	4.54
53	Cons. (Reynoldsville)	Harrison	Pittsburgh	A. D.	1.01	39.72	52.81	0.004	6.46	3.13							
54	Madeira - Hill - Clark C. Co. (Chieftain)	Harrison	Pittsburgh	A. D.	0.97	40.31	52.14	0.005	6.58	3.48	75.41	5.21	8.40	0.92	14207	13689	5.03
54	Madeira - Hill - Clark C. Co. (Chieftain)	Harrison	Pittsburgh	A. R.	1.54	40.08	51.84	0.005	6.54	3.46	74.98	5.24	8.87	0.91	14125	13609	4.87
55	Maderia - Hill - Clark C. Co. (Randolph)	Harrison	Pittsburgh	A. D.	1.08	39.73	51.13	0.006	8.06	4.42	75.75	4.82	5.85	1.10	13971	13733	5.45
55	Maderia - Hill - Clark C. Co. (Randolph)	Harrison	Pittsburgh	A. R.	1.80	39.44	50.76	0.006	8.00	4.38	75.20	4.87	6.46	1.09	13869	13633	5.20
56	Cons. No. 35 (O'Neill)	Harrison	Pittsburgh	A. D.	0.20	40.35	52.24	0.020	7.21	4.01	75.61	4.95	6.93	1.29	13609	13696	5.35
56	Cons. No. 35 (O'Neill)	Harrison	Pittsburgh	A. R.	0.65	40.17	52.00	0.020	7.18	3.99	75.27	4.98	7.30	1.28	13548	13634	5.20
57	Cons. (O'Neil No. 2)	Harrison	Pittsburgh		0.88	40.66	51.93	0.002	6.53	3.36							
58	Washington Coal Co.*	Harrison	Pittsburgh														
59	Washington Coal Co*	Harrison	Pittsburgh														
60	Cons. No. 50 (Perry No. 1)	Harrison	Pittsburgh	A. D.	0.25	40.05	53.65	0.006	6.05	2.91	76.97	5.00	7.91	1.16	13971	13800	5.51
60	Cons. No. 50 (Perry No. 1)	Harrison	Pittsburgh	A. R.	1.55	39.53	52.95	0.006	5.97	2.87	75.97	5.08	8.97	1.14	13789	13621	5.09
61	Cons. No. 50 (Perry No. 2)	Harrison	Pittsburgh	A. D.	0.30	39.70	53.05	0.008	6.95	3.83	76.38	4.86	6.83	1.15	13738	13751	5.64
61	Cons. No. 50 (Perry No. 2)	Harrison	Pittsburgh	A. R.	1.42	39.26	52.45	0.008	6.87	3.78	75.53	4.93	7.76	1.13	13584	13597	5.16

*Not in operation in 1910.—R. V. H.

ANALYSES OF COALS IN DODDRIDGE AND HARRISON COUNTIES.

(Under the heading "Condition of Sample" "A. D."=air dried, and "A. R."=as received).

Mine No. on Map	Mine.	County.	Horizon.	Condition of Sample.	Proximate.				Common to both.		Ultimate.				Calorimeter B. T. U. for 1 lb. of coal.	Calculated B. T. U. for 1 lb. of coal.	Carbon divided by Oxygen + Ash.
					Moisture.	Volatile Matter.	Fixed Carbon.	Phosphorus.	Ash.	Sulphur.	Carbon.	Hydrogen.	Oxygen.	Nitrogen.			
62	Madeira-Hill-Clark C. Co. (Waldo)	Harrison	Pittsburgh	A. D.	1.10	39.36	52.51	0.017	7.03	3.70	76.33	4.97	6.87	1.10	14026	13800	5.49
62	Madeira-Hill-Clark C. Co. (Waldo)	Harrison	Pittsburgh	A. R.	1.73	39.12	52.17	0.017	6.98	3.68	75.84	5.01	7.40	1.09	13937.	13712	5.27
62	Madeira-Hill-Clark C. Co. (Waldo, head coal)	Harrison	Pittsburgh	A. D.	0.85	39.26	45.53	0.004	14.36	8.10	67.23	4.52	4.77	1.02	13040	12537	3.51
62	Madeira-Hill-Clark C. Co. (Waldo, head coal)	Harrison	Pittsburgh	A. R.	1.07	39.18	45.43	0.004	14.32	8.08	67.08	4.53	4.97	1.02	13011	12509	3.48
63	Madeira-Hill-Clark C. Co. (Goff)	Harrison	Pittsburgh	A. D.	0.96	39.61	53.71	0.011	5.72	2.76	79.07	4.92	6.41	1.12	14526	14167	6.52
63	Madeira-Hill-Clark C. Co. (Goff)	Harrison	Pittsburgh	A. R.	1.35	39.45	53.50	0.011	5.70	2.75	78.76	4.94	6.74	1.11	14469	14109	6.53
64	Fairmont and Balto. C. & C. Co. (Fairmore)	Harrison	Pittsburgh	A. D.	0.77	37.66	56.44	0.029	5.13	2.24	77.78	5.28	8.33	1.24	14107	14033	5.78
64	Fairmont and Balto. C. & C. Co. (Fairmore)	Harrison	Pittsburgh	A. R.	1.53	37.37	56.01	0.029	5.09	2.22	77.18	5.32	8.96	1.23	13999	13925	5.49
65	Cons. No. 25 (Pinnickinnick)	Harrison	Pittsburgh	A. D.	0.30	36.90	56.44	0.036	6.36	1.91	77.09	5.05	8.11	1.48	13839	13795	5.33
65	Cons. No. 25 (Pinnickinnick)	Harrison	Pittsburgh	A. R.	1.13	36.60	55.96	0.036	6.31	1.89	76.45	5.10	8.78	1.47	13725	13680	5.07
66	Cons. No. 58 (Despard)	Harrison	Pittsburgh	A. D.	0.25	30.58	62.84	0.019	6.33	2.71	76.48	5.06	8.08	1.34	14067	13745	5.31
66	Cons. No. 58 (Despard)	Harrison	Pittsburgh	A. R.	1.15	30.31	62.26	0.019	6.28	2.69	75.82	5.11	8.77	1.33	13945	13625	5.04
67	Cons. No. 29 (Columbia)	Harrison	Pittsburgh	A. D.	0.60	36.65	55.31	0.016	7.44	3.13	76.86	4.94	6.32	1.31	13882	13819	5.59
67	Cons. No. 29 (Columbia)	Harrison	Pittsburgh	A. R.	1.03	36.49	55.07	0.016	7.41	3.12	76.53	4.96	6.67	1.31	13832	13819	5.44
68	Cons. No. 52 (Ocean)	Harrison	Pittsburgh	A. D.	0.63	40.34	53.93	0.012	5.10	2.29	80.65	4.50	6.20	1.26	14160	14136	7.14
68	Cons. No. 52 (Ocean)	Harrison	Pittsburgh	A. R.	1.50	39.99	53.45	0.012	5.06	2.27	79.95	4.55	6.92	1.25	14037	14013	6.67
69	Central Fairmont Coal Co.	Harrison	Pittsburgh	A. D.	0.39	37.15	56.76	0.035	5.70	2.49	78.14	5.20	7.22	1.25	14119	14132	6.05
69	Central Fairmont Coal Co.	Harrison	Pittsburgh	A. R.	1.61	36.69	56.07	0.035	5.63	2.46	77.18	5.28	8.22	1.23	13945	13958	5.57
70	Vincent Coal Co.	Harrison	Pittsburgh	A. D.	0.40	41.48	50.81	0.026	7.31	3.89	75.42	5.16	7.06	1.16	13858	13781	5.25

ANALYSES OF COALS IN DODDRIDGE AND HARRISON COUNTIES.

(Under the heading "Condition of Sample" "A. D."=air dried, and "A. R."=as received).

Mine No. on Map	Mine.	County.	Horizon.	Condition of Sample.	Proximate.				Common to both.		Ultimate.				Calorimeter B. T. U. for 1 lb. of coal.	Calculated B. T. U. for 1 lb. of coal.	Carbon divided by Oxygen + Ash.
					Moisture.	Volatile Matter.	Fixed Carbon.	Phosphorus.	Ash.	Sulphur.	Carbon.	Hydrogen.	Oxygen.	Nitrogen.			
70	Vincent Coal Co.	Harrison	Pittsburgh	A. R.	2.08	40.78	49.95	0.026	7.19	3.82	74.15	5.26	8.44	1.14	13624	13548	4.7
71	Barnard Coal Co.	Harrison	Pittsburgh	A. D.	2.15	37.47	55.02	0.011	5.36	1.99	76.79	5.18	9.58	1.10	14026	13800	5.1
71	Barnard Coal Co.	Harrison	Pittsburgh	A. R.	4.89	36.42	53.48	0.011	5.21	1.93	74.65	5.34	11.80	1.07	13937	13712	4.3
72	Harry B. C. & C. Co. (Pitcairn)	Harrison	Pittsburgh	A. D.	0.77	39.19	53.84	0.014	6.20	3.04	76.99	5.26	7.15	1.36	14042	14031	5.7
72	Harry B. C. & C. Co. (Pitcairn)	Harrison	Pittsburgh	A. R.	0.93	39.13	53.75	0.014	6.19	3.04	76.86	5.27	7.28	1.36	14019	14009	5.7
73	Cons. No. 31 (Dixie)	Harrison	Pittsburgh		0.54	41.01	52.88	0.003	5.57	2.52							
74	Cons. No. 46 (Lynch)	Harrison	Pittsburgh	A. D.	0.76	37.69	54.77	0.020	6.78	3.37	75.64	5.15	7.57	1.49	13861	13748	5.2
74	Cons. No. 46 (Lynch)	Harrison	Pittsburgh	A. R.	1.06	37.58	54.60	0.020	6.76	3.36	75.41	5.17	7.81	1.49	13819	13707	5.1
75	Cons. No. 39 (Two Lick)	Harrison	Pittsburgh	A. D.	0.82	35.40	57.78	0.022	6.00	2.12	77.40	5.31	7.78	1.39	13953	14035	5.6
75	Cons. No. 39 (Two Lick)	Harrison	Pittsburgh	A. R.	0.92	35.37	57.72	0.022	5.99	2.12	77.32	5.31	7.87	1.39	13939	14021	5.5
76	Marshall Coal Co.	Harrison	Pittsburgh	A. D.	1.34	35.53	57.94	0.022	5.19	2.24	77.49	5.26	8.48	1.34	13938	13966	5.6
76	Marshall Coal Co.	Harrison	Pittsburgh	A. R.	1.53	35.46	57.83	0.022	5.18	2.24	77.34	5.27	8.63	1.34	13911	13939	5.6
77	Byron Coal Co.	Harrison	Pittsburgh	A. D.	0.95	37.33	56.40	0.016	5.32	2.72	76.76	5.17	8.78	1.25	13990	13805	5.4
77	Byron Coal Co.	Harrison	Pittsburgh	A. R.	1.55	37.11	56.07	0.016	5.29	2.70	76.31	5.21	9.25	1.24	13908	13724	5.2
78	Cons. No. 60 (West Fork)	Harrison	Pittsburgh	A. D.	0.53	39.13	54.23	0.015	6.11	3.37	77.71	5.08	6.57	1.16	14000	14081	6.1
78	Cons. No. 60 (West Fork)	Harrison	Pittsburgh	A. R.	1.41	38.78	53.75	0.015	6.06	3.34	77.03	5.14	7.28	1.15	13877	13957	5.7
79	Daniel Coal Co.	Harrison	Pittsburgh	A. D.	0.92	37.32	55.98	0.025	5.78	2.47	77.13	5.06	8.27	1.29	13968	13811	5.4
79	Daniel Coal Co.	Harrison	Pittsburgh	A. R.	1.22	37.21	55.81	0.025	5.76	2.46	76.90	5.08	8.52	1.28	13927	13770	5.3
80	Hutchinson Coal Co. (Byron)	Harrison	Pittsburgh	A. D.	0.73	38.63	54.99	0.028	5.65	2.41	77.52	5.10	8.02	1.30	13943	13915	5.6
80	Hutchinson Coal Co. (Byron)	Harrison	Pittsburgh	A. R.	1.99	38.14	54.29	0.028	5.58	2.38	76.54	5.18	9.04	1.28	13766	13740	5.2
81	Cons. No. 44 (Interstate No. 1)	Harrison	Pittsburgh	A. D.	1.15	37.71	54.85	0.019	6.29	3.60	75.90	5.31	7.49	1.41	13970	13893	5.5
81	Cons. No. 44 (Interstate No. 1)	Harrison	Pittsburgh	A. R.	1.42	37.61	54.70	0.019	6.27	3.59	75.69	5.33	7.71	1.41	13931	13854	5.4
82	Cons. No. 64 (Interstate No. 2)	Harrison	Pittsburgh	A. D.	0.91	38.56	54.16	0.025	6.37	3.31	76.02	5.19	7.97	1.14	13920	13796	5.3
82	Cons. No. 64 (Interstate No. 2)	Harrison	Pittsburgh	A. R.	1.42	38.37	53.88	0.025	6.33	3.29	75.64	5.22	8.38	1.13	13849	13726	5.1
83	Jacob Post	Harrison	Pittsburgh	A. R.	0.64	40.98	51.75	0.034	6.63	4.83	75.80	5.00	6.80	0.94	13730	13794	5.6

ANALYSES OF COALS IN DODDRIDGE AND HARRISON COUNTIES.

(Under the heading "Condition of Sample" "A. D."=air dried, and "A. R."=as received).

Mine No. on Map	Mine.	County.	Horizon.	Condition of Sample.	Proximate.				Common to both.		Ultimate.				Calorimeter B. T. U. for 1 lb. of coal.	Calculated B. T. U. for 1 lb. of coal.	Carbon divided by Oxygen + Ash.
					Moisture.	Volatile Matter.	Fixed Carbon.	Phosphorus.	Ash.	Sulphur.	Carbon.	Hydrogen.	Oxygen.	Nitrogen.			
84	Clarksburg Gas Coal Co......	Harrison .	Pittsburgh	A. D.	1.50	38.61	53.96	0.027	5.93	3.56	75.73	5.63	7.96	1.19	13959	14036	5.45
84	Clarksburg Gas Coal Co......	Harrison .	Pittsburgh	A. R.	6.05	36.83	51.46	0.026	5.66	3.40	72.23	5.88	11.69	1.14	13315	13389	4.16
	Average	Harrison .	Pittsburgh	A. D.	0.79	38.55	53.97	0.023	6.69	2.95	76.65	5.01	7.46	1.24	13911	13802	5.42
	Average	Harrison .	Pittsburgh	A. R.	1.63	38.24	53.53	0.023	6.60	2.94	76.04	5.06	8.14	1.22	13800	13695	5.16
85	Gore Heirs.................	Harrison .	Little Clarksburg.....	A. R.	1.25	30.96	43.33	0.043	24.46	8.22	56.38	4.03	5.91	1.00	10572	10573	1.86
86	G. W. Moffett...............	Harrison .	West Milford (Hennen)	A. R.	1.01	36.27	54.93	0.010	7.79	4.05	74.57	5.01	7.41	1.17	13562	13546	4.91
86	G. W. Moffett...............	Harrison .	West Milford (Reger)	A. R.	0.94	35.43	51.42	0.014	12.21	5.88	70.56	4.67	5.50	1.18	12977	12972	3.99
87	J. I. Brohard...............	Harrison .	Harlem	A. R.	0.70	36.50	51.48	0.032	11.32	3.01	72.82	4.81	6.82	1.22	13412	13169	4.01
88	B. & O. R. R.................	Harrison .	Harlem	A. R.	0.95	36.52	52.32	0.008	1021	4.09	74.02	4.66	5.94	1.08	13562	13344	4.58
89	Cornell and Lang...........	Harrison .	Harlem	A. R.	0.84	35.71	51.45	0.034	12.00	4.05	71.00	4.78	6.90	1.27	13135	13921	3.76
90	Isaac Maxwell..............	Harrison .	Harlem	A. R.	7.01	37.95	42.68	0.038	12.36	1.37	59.43	4.12	21.69	1.03	10226	9574	1.75
91	Isaac Maxwell..............	Harrison .	Harlem	A. R.	5.99	32.34	50.59	0.036	11.08	1.60	63.88	4.84	17.48	1.12	11148	10947	2.24
	Average	Harrison .	Harlem	A. R.	3.10	35.81	49.70	0.030	11.39	2.82	68.23	4.65	11.77	1.14	12297	11991	3.27
	W. M. Gray No. 1, oil well (625)	Harrison .	Upper Kittanning.....	A. D.	0.18	37.80	48.20	0.039	13.82	2.49	71.98	4.75	5.80	1.16	13105	13069	3.67
	W. M. Gray No. 1, oil well (625)	Harrison .	Upper Kittanning.....	A. R.	1.44	37.32	47.60	0.039	13.64	2.40	71.07	4.83	6.91	1.15	12939	12903	3.46
	W. M. Gray No. 1, oil well (625)	Harrison .	Lower Mercer?........	A. D.	0.45	39.16	50.49	0.010	9.90	1.04	76.63	4.94	6.32	1.17	13996	13761	4.72
	W. M. Gray No. 1, oil well (625)	Harrison .	Lower Mercer?........	A. R.	0.57	39.11	50.43	0.010	9.89	1.03	76.54	4.94	6.44	1.16	13979	13745	4.69

Page reference to detailed description and section of coal mines listed in preceding table.

Map No.	Laboratory No.	Name of Owner.	Page of this Report.
1	450-H	J. D. Benedum	160
2	460-H	R. M. Orr	161
3	452-H and 453-H	D. H. Nicholson	165
4	461-H	W. A. Stutler	189
5	462-H	Alfred C. Collins	190
6	472-H and 472-H (A)	L. P. Loudin	207
7	473-H	Gary Harris	209
8	480-H	James McIntyre	211
9	523-H	Clarksburg Gas Coal Co	571
10	524-H	High Grade Coal Co	572
11	522-H	Kroger Gale Coal Co	572
12	510-H	Marion Gas Coal Co	578
13	531-H	Consolidation Coal Co. No. 49 (Enterprise)	579
13A	706-H	Monongah Fuel Co	579
14	532-H	Consolidation Coal Co. No. 40 (Viropa)	580
15	533-H	Consolidation Coal Co. No. 66 (Riverdale)	581
16	516-H	Consolidation Coal Co. No. 65 (Solon)	580
17	517-H	Consolidation Coal Co. No. 51 (Ehlen)	581
18	538-H	Consolidation Coal Co. No. 42 (Robinson Run)	582
19	505-H	Haywood Coal Mining Co	582
20	537-H	Consolidation Coal Co. No. 36 (Lucas)	583
21	536-H	Consolidation Coal Co. No. 54 (Pooz)	583
22	512-H	Virginia and Maryland Coal Corporation (Willard No. 2)	584
23	511-H	Virginia and Maryland Coal Corporation (Willard No. 1)	584
24	556-H and 552-H	Consolidation Coal Co. No. 61 (Owings)	585
25	555-H	Consolidation Coal Co. No. 32 (Owings)	585
26	457-H	J. R. Bartlett	575
27	553-H	Short Line Coal Co. (Girard No. 2, New opening)	586
28	552-H	Short Line Coal Co. (Girard No. 2, Old opening)	586
29	503-H	Fayette Coal Co	587
30	504-H	National Coal Co	587
31	509-H	Swiger Coal Co	588
32	508-H	Peacock Coal Co	588
33	507-H	Rosebud Fuel Co	589
34	506-H	Lumberport Steam Coal Co	589
35	513-H	Blue Ridge Coal Co	590
36	535-H	Hero Coal & Coke Co	590
37	534-H	Consolidation Coal Co. No. 21 (Gypsy)	590
38	Bull. II, p. 326	Consolidation Coal Co. Maulsby)	591
39	499-H	Lambert Run Coal Co	591
40	545-H and 546-H	Consolidation Coal Co. No. 55 (Meadowbrook)	592
41	500-H	Cook Coal & Coke Co (Girard No. 1)	592
42	501-H	Harrison County Coal Co	593
43	502-H	Hutchinson Coal Co. (Erie)	593
44	518-H	Consolidation Coal Co No. 33 (Globe)	594

Map No.	Laboratory No.	Name of Owner.	Page of this Report.
45	Bull. II, p. 326	Consolidation Coal Co. (Glen Falls)	594
46	548-H	Consolidation Coal Co. No. 27 (Dunham)	594
47	549-H	Consolidation Coal Co. No. 48 (Falls Run)	595
48	539-H	Consolidation Coal Co. No. 62 (Perry No. 3)	595
49	515-H	Corona Coal & Coke Co	596
50	498-H	Chas. T. Moore	596
51	497-H	O'Gara Coal Co	597
52	496-H	Hutchinson Coal Co. (Delta)	597
53	Bull. II, p. 321	Consolidation Coal Co. (Reynoldsville)	597
54	495-H	Madeira-Hill-Clark Coal Co. (Chieftain)	598
55	494-H	Madeira-Hill-Clark Coal Co. (Randolph)	598
56	542-H	Consolidation Coal Co. No. 35 (O'Neil No. 1)	599
57	Bull. II, p. 321	Consolidation Coal Co. (O'Neil No. 2)	599
58	None	Washington Coal Co	599
59	None	Washington Coal Co	599
60	540-H	Consolidation Coal Co. No. 50 (Perry No. 2)	600
61	541-H	Consolidation Coal Co. No. 50 (Perry No. 1)	599
62	491-H and 492-H	Madeira-Hill-Clark Coal Co. (Waldo)	600
63	493-H	Madeira-Hill-Clark Coal Co. (Goff)	601
64	514-H	Fairmont and Baltimore Coal and Coke Co.	601
65	544-H	Consolidation Coal Co. No. 25 (Pinnickinnick)	602
66	543-H	Consolidation Coal Co. No. 58 (Despard)	603
67	547-H	Consolidation Coal Co. No. 29 (Columbia)	603
68	550-H	Consolidation Coal Co. No. 52 (Ocean)	604
69	558-H	Central Fairmont Coal Co	607
70	554-H	Vincent Coal Co	608
71	490-H	Barnard Coal Co	608
72	530-H	Harry B. Coal & Coke Co. (Pitcairn)	609
73	Bull. II, p. 321	Consolidation Coal Co. No. 31 (Dixie)	610
74	529-H	Consolidation Coal Co. No. 46 (Lynch)	610
75	528-H	Consolidation Coal Co. No. 39 (Two Lick)	611
76	527-H	Marshall Coal Co	611
77	525-H	Byron Coal Co	612
78	551-H	Consolidation Coal Co. No. 60 (West Fork)	612
79	526-H	Daniel Coal Co	613
80	519-H	Hutchinson Coal Co. (Byron)	613
81	521-H	Consolidation Coal Co. No. 44 (Interstate No. 1)	614
82	520-H	Consolidation Coal Co. No. 64 (Interstate No. 2)	614
83	481-H	Jacob Post	576
84	523-H	Clarksburg Gas Coal Co	615
85	478-H	Gore Heirs	233
86	474-H and 484-H	G. W. Moffett	246
87	467-H	J. I. Brohard	256
88	455-H	Baltimore & Ohio Railroad cut	257
89	466-H	Cornell and Lang	258
90	485-H	Isaac Maxwell	261
91	468-H	Isaac Maxwell	260
	559-H and 560-H	W. M. Gray No. 1 Oil well (625)	620

CHAPTER X.

CLAYS, ROAD MATERIALS, BUILDING STONES, FORESTS AND CARBON BLACK.

CLAYS AND CLAY INDUSTRY.

In Vol. III of the State Geological Survey reports may be found a general review of the clay industry in the State by G. P. Grimsley, along with a discussion of the origin, physical and chemical properties, and classification of clays and their uses, to which the reader is referred for such data and the technology of the industry.

In the Doddridge-Harrison area at this time there are two pottery and five brick plants, all located in Harrison county. There are many places in the two counties where the shales and alluvial clays could be used for brick manufacture. The location of these alluvial or old terrace clays are outlined on the economic geology map accompanying this report.

Potteries.

West Virginia Pottery Company.

This plant is located in the town of Bridgeport. A brief account of its organization, pay roll and number of persons employed is given in connection with the industries of the latter place, page 27. G. P. Grimsley gives an interesting account of this establishment as it was running in 1905 on pages 161-162 of Vol. III of the State Survey reports.

According to information furnished by G. B. Late, Supt., in February, 1912, this plant now manufactures a plain line of stone ware, principally jugs and jars. It has a capacity of 1400 gallons daily, which is disposed of to jobbers at about 4 cents a gallon.

The old Sandusky clay pit near Bridgeport, as described by Mr. Grimsley, has been abandoned, and clay only from near Hardman, Taylor county, is used. According to Mr. Late, the Sandusky clay contained too much iron, causing the product to burn to an objectionable red color, being better adapted to the manufacture of building brick than stoneware.

This company once opened a clay pit in the Clarksburg Fire Clay Shale on the ridge, 1.5 miles due north of Bridgeport, a full account of which along with an analysis of the clay is given on page 236. Although this clay was adapted to the manufacture of a fine grade, buff colored building and paving brick, yet it fused at too low a temperature for fire brick purposes. The clay was too plastic to manufacture stoneware, in that it required too long a time to wash and get rid of the water—taking 4 hours as against only 40 minutes for the Hardman clay. Natural gas is used for fuel and is furnished by a local company at the rate rate of 4 cents a thousand cubic feet.

A. Radford Pottery Company.

This plant is located a short distance east of Clarksburg in the town of Industrial, an account of which is given on page 19 in connection with the description of the industries of the former place. As will appear, none of the clay used is obtained in the Doddridge-Harrison area, but has been attracted to this place by the low price—4 cents a thousand cubic feet—of natural gas. Part of the clay used, however, is obtained near Hardman, Taylor county.

Transported Clays.

In the vicinity of Salem, Harrison county, there occurs an irregular deposit of grayish white and rather plastic clay that appears to possess the required physical and chemical properties for pottery manufacturing purposes. In the writer's judgment this clay is not residual, but transported

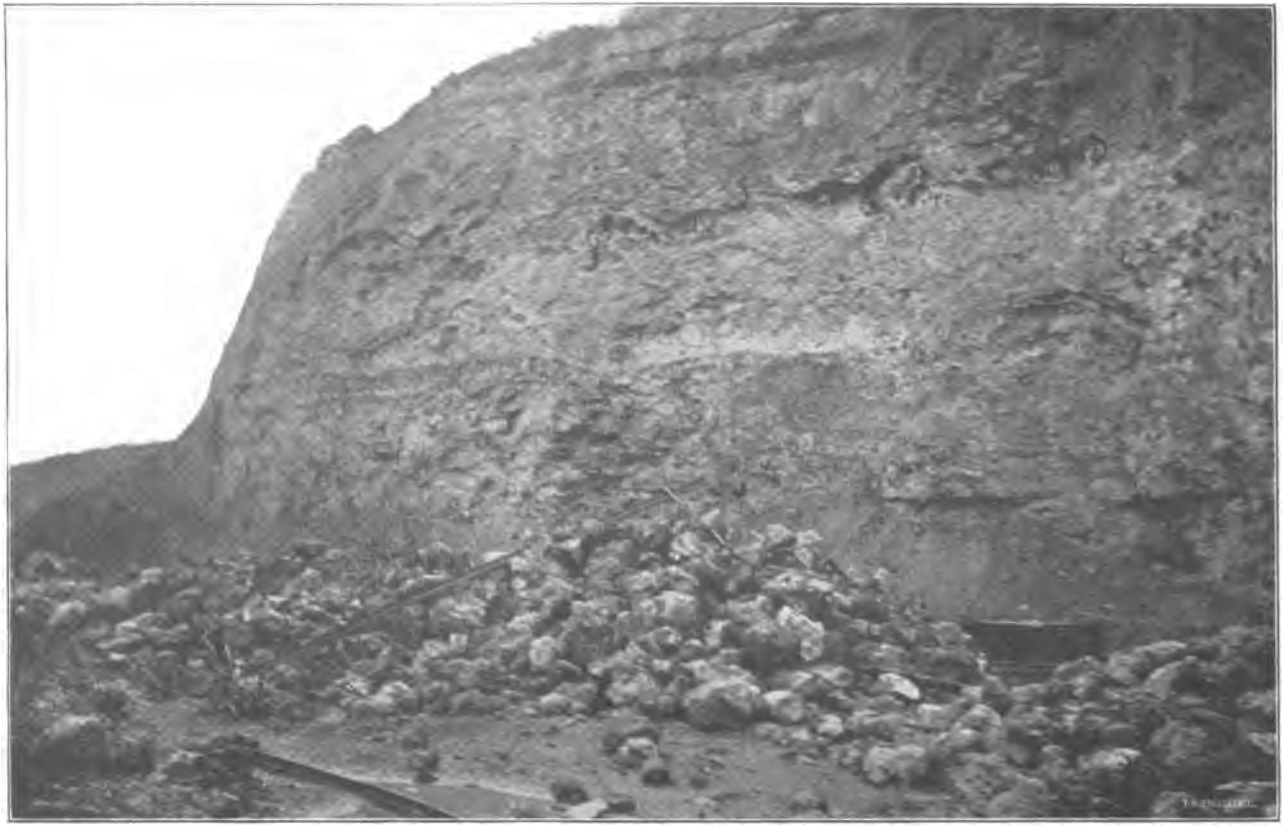


PLATE XXII.—High Grade Brick Company Pit, showing Coal, Clay and Shale, Clarksburg,

in comparatively recent time in a geologic sense. It is probably an indirect effect of one of the great ice dams formed during the glacial period of the earth's history. During this time a great ice sheet came down from the north and backed up the tributaries of the old Pittsburgh river, forming a great lake whose surface elevation reached about 1100 feet above present sea level—approximately the elevation of this clay deposit —and later subsided, leaving mute testimony of the fact along its old shore lines in the way of gravel, rounded boulders and pebbles, and deposits of grayish white clay along the valley walls of the Monogahela and Cheat rivers of this State. Owing to the nature of the deposit, and the narrow valley at Salem, it is not probable that the clay occurs in sufficient quantity to be considered an important economic resource.

In November, 1911, D. B. Reger visited this region and collected two samples of the clay for analysis, the composition of which is reported by Prof. Hite as follows:

Analyses of Clays Near Salem.

	No. 674-H Per cent.	No. 675-H Per cent.
Silica ($Si O_2$)	69.70	68.36
Ferric Iron (Fe_2O_3)	4.74	3.42
Alumina (Al_2O_3)	14.53	17.33
Lime ($Ca O$)	0.58	0.10
Magnesia ($Mg O$)	0.72	1.36
Sodium (Na_2O)	0.95	0.33
Potassium (K_2O)	2.65	2.65
Titanium ($Ti O_2$)	0.64	0.48
Phosphoric Acid (P_2O_5)	0.05	0.16
Moisture at 105°	1.62	1.06
Loss on ignition	3.78	5.35
Totals	99.96	100.60

Sample No. 674-H was collected from a town lot, ¼ mile northwest of the mouth of Jacobs run at Salem; and No. 675-H, in the Baltimore & Ohio Railroad cut at the west edge of Industrial, close to the Doddridge-Harrison county line. At the point the first sample was taken, Mr. Reger reports a thickness of 4 feet of white clay without reaching bottom; and at the latter point, 13 feet of white clay. He reports both at about the same elevation—1080′ to 1100′ A. T.—and as having the appearance of old secondary creek deposits.

The analyses show that the clay compares favorably with other pottery clays of the State, as will readily be observed from an examination of Table I, facing page 26 of Vol. III of the State Geological Survey reports. The clay appears sufficiently plastic to mould well, but it must be kept in mind that any clay must be worked into the finished product to determine its real worth.

The writer collected another sample of this alluvial or transported clay along the hill road, 1.7 miles due west of Byron, Harrison county. Here, the deposit is grayish white in color, plastic, and 6 feet thick, coming at an elevation of 1060' A. T., aneroid The composition is reported by Prof. Hite as follows:

Analysis of Clay, 1.7 Miles West of Byron.

	Per cent.
Silica (SiO_2)	82.20
Ferric Iron (Fe_2O_3)	2.26
Alumina (Al_2O_3)	6.88
Lime (CaO)	1.34
Magnesia (MgO)	0.58
Sodium (Na_2O)	0.82
Potassium (K_2O)	1.21
Titanium (TiO_2)	0.40
Phosphoric Acid (P_2O_5)	0.84
Loss on ignition	3.62
Total	100.15

The results show the clay too high in silica and too low in alumina for pottery purposes, as will appear from an examination of Table I in the reference above given. Owing to the lack of fine, high grade fire clays in the Dunkard, Monongahela and Conemaugh series, it is quite doubtful whether any of the residual clays that crop in the two counties will ever prove a success in the manufacture of the different kinds of pottery where high temperatures are required in their making.

Brick Plants.

The brick industry in the Doddridge-Harrison area is confined entirely to Harrison county. Only building and paving brick are manufactured.

Monticello Brick Company.

The plant of the Monticello Brick Company is located one mile southwest of Clarksburg on the east bank of West Fork river. According to information furnished D. B. Reger by Frank L. Bennett, Manager, it was established in 1896, and employment is furnished for 16 men, the plant having a yearly output of 2½ million building brick.

Shale Pit.—Mr. Reger collected samples for analysis and measured the following section at the shale pit:

	Feet.
River clay, yellowish	15
Shale, variegated, mostly red (Clarksburg)	15

Chemical Analysis.—Two samples, representing each formation, were collected, the composition of which is reported by Prof. Hite as follows:

	River clay. Per cent.	Shale. Per cent.
Silica ($Si\ 0_2$)	76.18	51.20
Ferric Iron (Fe_20_3)	7.28	10.78
Alumina (Al_20_3)	7.98	12.46
Lime ($Ca\ 0$)	1.24	6.04
Magnesia ($Mg\ 0$)	0.76	1.12
Sodium (Na_20)	0.77	1.63
Potassium (K_20)	1.59	4.46
Titanium ($Ti\ 0_2$)	0.40	0.22
Phosphoric Acid (P_20_5)	0.02	0.53
Loss on ignition	4.19	11.31
Totals	100.41	99.75

The clay and shale are mixed, in the proportion, 1 part clay to 2 parts shale. The clay alone makes good brick, but shrinks too much in burning. The shale also makes good brick alone, but it has to be run first through a very fine sieve. G. P. Grimsley gives an interesting account of this plant on pages 247-248 of Vol. III of the State Geological Survey reports.

Clarksburg High Grade Shale Brick Company.

In addition to the last described plant using shales below the Pittsburgh coal, there is another that utilizes the shales immediately over the same coal in the Clarksburg region, an interesting account of which is published on pages 250-252 of Vol. III of the State Survey reports.

The Glen View Brick Company.

The Glen View Brick Company, successor to the Glen Elk Brick Company, has its plant in the north edge of Clarksburg. According to information furnished D. B. Reger by John Patton, Pres., the plant was established in 1900, and employment is furnished for 18 men, the concern having a yearly output of two to three million building and sidewalk brick.

Shale Pit.—Mr. Reger measured the following section at the shale pit:

		Feet.
1.	Clay	8
2.	Shale, brown	4
3.	Sandstone, shaly	3
4.	Shale, dark gray	17
5.	Coal, Redstone	0.5
6.	Shale	4
7.	Limestone, Redstone	4
8.	Shale, limy	14
9.	Coal, Pittsburgh	10

Mr. Reger reports that formations Nos. 1 and 4 of the section are mixed in equal parts in making the brick.

Chemical Analysis.—He also collected a sample for analysis from No. 4 of section the composition of which is reported by Prof. Hite as follows:

	Per cent.
Silica ($Si\ 0_2$)	67.20
Ferric Iron (Fe_20_3)	4.16
Alumina (Al_20_3)	14.16
Lime ($Ca\ 0$)	2.24
Magnesia ($Mg\ 0$)	1.34
Sodium (Na_20)	1.42
Potassium (K_20)	3.70
Titanium ($Ti\ 0_2$)	0.18
Phosphoric Acid (P_20_5)	0.46
Loss on ignition	5.37
Total	100.23

G. P. Grimsley gives an interesting account of this plant

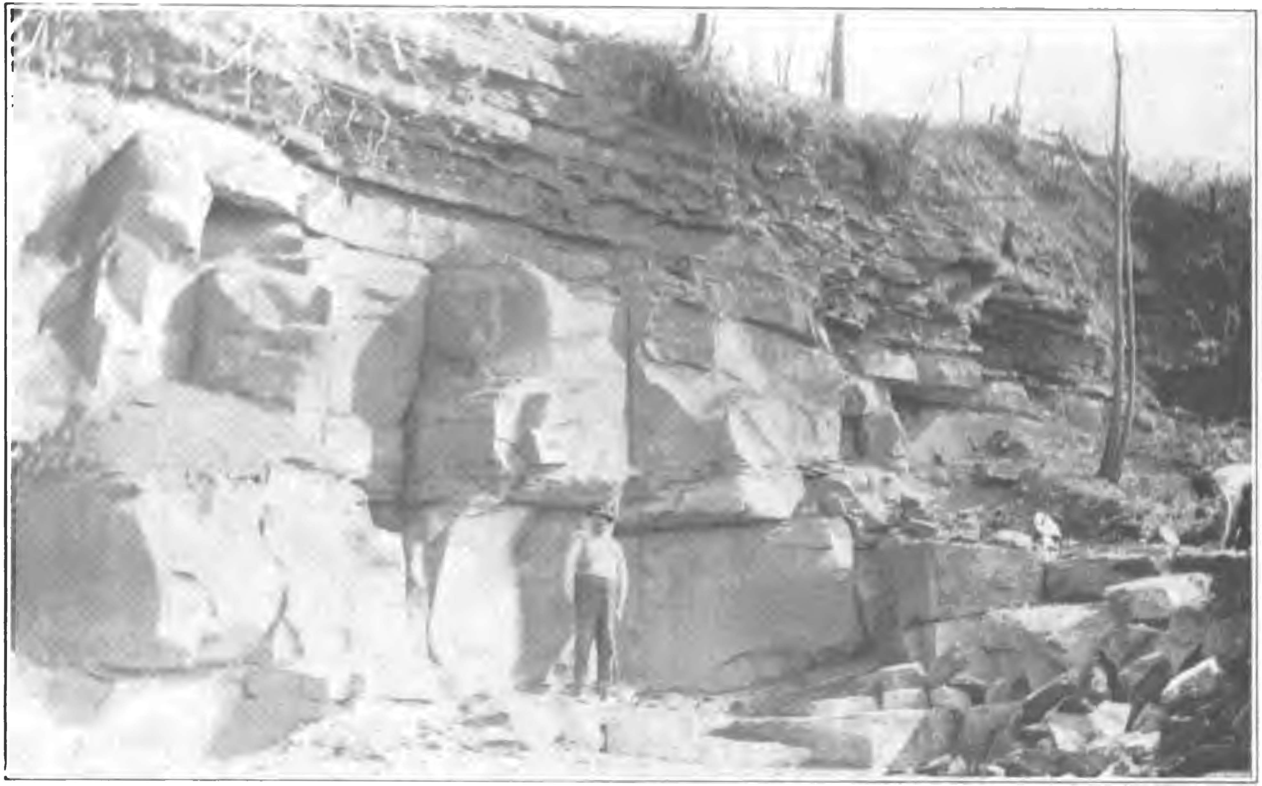


PLATE XXIII.—Jackson quarry in Arnoldsburg sandstone at Clarksburg, Harrison County.

wh
25

M
ar
W
te
d
a
n
L
n
v
t
t
a

when it was run by the Glen Elk Brick Company on page 252 of Vol. III of the State Geological Survey reports.

Lee Brick Plant, West Milford.

According to information furnished D. B. Reger by Mason Lee, the operator, this plant was established in 1902 and abandoned in 1911. It is located on the south bank of West Fork river, 400 to 500 feet east of the bridge over the latter stream at West Milford. The clay operated was an alluvial deposit, reddish yellow and 8 feet thick, coming only 7 feet above water level of the river. Employment was furnished for 5 men, and the capacity of the plant, 4000 to 5000 building brick daily. The brick were moulded by hand; that is, no machinery was used. They were also air dried, and burned with wood for fuel into two kinds of brick—hard and soft—the hard being on the inside of the kiln. The product was used entirely to supply the local demands of West Milford and vicinity.

The Shinnston Brick Company.

This plant is located in the east edge of Shinnston, and according to information given D. B. Reger by C. A. Short, Pres., it was established in August, 1910. Building brick was manufactured and only one kiln was ever burned, the plant having been shut down for some time on account of a lack of funds. The clay pit, according to Mr. Reger, occurs in an alluvial or terrace deposit of clay, at an elevation of 1010' A. T., aneroid, the raw clay being yellowish and burning to a pale red. The brick were wire cut and dried in 4 driers with natural gas for fuel, and then burned in a rectangular kiln. Employment was furnished for 8 men when running at full capacity. The plant is now owned by Thomas Hawker.

According to Mr. Short, a potter's clay was once mined at a lower level at this place, and burned into a fine grade of pottery, mostly stoneware.

The Washington fire clay shale of the Dunkard series, and the Clarksburg and Pittsburgh red shales of the Conemaugh, along with the great deposits of alluvial clays on the old river terraces of West Fork, should furnish an almost inexhaustible supply of material adapted to the manufacture of paving and building brick. Another feature in favor of the brick industry for this region is the fact that this locality is immediately surrounded by one of the greatest natural gas and coal fields of the State, thus insuring an abundant supply of cheap fuel for many years in the future.

ROAD MATERIAL.

As mentioned at the beginning of Chapter I, the public highways of the Doddridge-Harrison area have received rather indifferent attention until within the last three years; hence, the subject of road material has become of great importance to the residents thereof. The Northwestern Turnpike, between Clarksburg and Salem, has recently been macadamized with limestone largly from the eastern Pan-handle counties of the State. In other portions of both counties, dirt and broken sandstone have constituted the greater portion of the material used in making and maintaining the roads, the latter becoming almost impassable during the winter season in the oil and gas fields of both counties.

Limestones.

Nearly all varieties of limestones can be used to advantage in surfacing road beds, but those that combine best cementing properties along with good wearing qualities are preferred. The following limestones that are adapted for road material, crop in the Doddridge-Harrison area:

Monongahela Series.	Pages.	Conemaugh Series.	Pages.
Uniontown Limestone	193	Upper Pittsburgh Limestone	225
Benwood Limestone	197	Clarksburg Limestone	237
Sewickley Limestone	202	Elk Lick Limestone	245
Redstone Limestone	212	Ames Limestone	250
		Ewing Limestone	262

The chemical composition, thickness and character of these limestones, along with a discussion of their crop and availability are given on the pages indicated above in this report, to which the reader is referred for specific information for each stratum.

River and Creek Gravels.

In the foregoing county reports prepared by the writer special emphasis has been placed on the fact that the cheapest and greatest source of good road material, and one that is most frequently overlooked, is the deposit of gravel along the beds of the larger streams. The Doddridge-Harrison area is no exception to this rule. There may be found large deposits of gravel that is already pounded and worn down by attrition to a size suitable for direct application to the surface of road beds, along all the larger streams in both counties.

BUILDING STONE.

Some of the limestones mentioned under "Road Materials" above might be used to advantage for building purposes for foundations and chimneys in the rural districts in the immediate locality of their crop in both counties. The harder ledges might take a good polish and thus serve for ornamental work. On account of their brittle nature they would have to be quarried by use of wedges, as blasting would probably shatter them.

The sandstones of the area under discussion should furnish an almost inexhaustible supply of fair building material. The following is a list in descending order of the sandstones that crop to the surface that are available and of sufficient thickness and durability to warrant quarrying in some cases for local supply, and in others, for shipping purposes. Those in black face type have already been quarried to some extent. The thickness, character and distribution of these several ledges are discussed at length in this report on the pages indicated at the right hand margin of the list:

	Pages.
Dunkard Series.	
Nineveh Sandstone	147
Jollytown Sandstone	151
Hundred Sandstone	153
Upper Marietta Sandstone	153
Lower Marietta Sandstone	156
Mannington Sandstone	170
Waynesburg Sandstone	174
Monongahela Series.	
Gilboy Sandstone	186
Uniontown Sandstone	186
Arnoldsburg Sandstone	194
Upper Sewickley Sandstone	199
Lower Sewickley Sandstone	201
Conemaugh Series.	
Lower Pittsburgh Sandstone	224
Connellsville Sandstone	229
Morgantown Sandstone	241
Grafton Sandstone	248
Saltsburg Sandstone	264
Buffalo Sandstone	268

McGeorge Quarry at Clarksburg—Arnoldsburg Sandstone.

On pages 453-454 of Vol IV of the State Geological reports, G. P. Grimsley gives an account of the McGeorge quarry on what appears to be the Arnoldsburg sandstone and not the Uniontown as given by Mr. Grimsley, a more detailed discussion of which is given by the writer in the description of the Uniontown and Arnoldsburg sandstones in Chapter VI of this report.

T. M. Jackson Quarry at Clarksburg—Arnoldsburg Sandstone.

On pages 455-457 of Vol. IV of the State Geological reports, G. P. Grimsley gives an account of the T. M. Jackson quarry on what appears to be the Arnoldsburg and not the Uniontown sandstone as discussed more in detail in the description of these ledges in Chapter VI of this report.

Physical Tests.—Samples of stones from the Jackson quarry were sent during 1908 to the testing laboratory of the U. S. Geological Survey at St. Louis, Mo., for physical tests, the results of which are published on pages 566 and 567 of Vol. IV of the State survey reports.

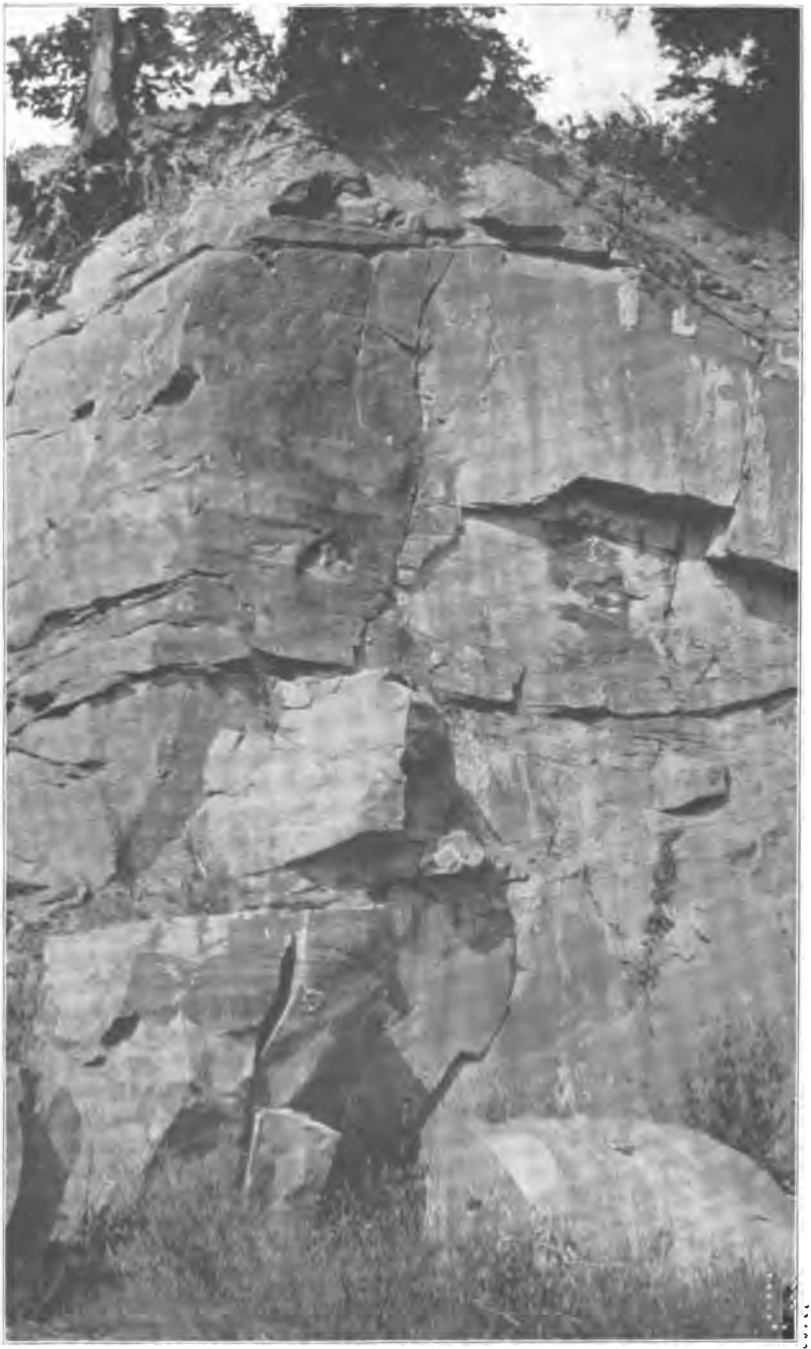


PLATE XXIV.—Fred Flowers quarry in Lower Sewickley sandstone, near Gore, 2 miles north of Clarksburg. (See Gore section).

Porter Smith Quarry at Farnum.—Connellsville Sandstone.

G. P. Grimsley gives an account of the Porter Smith quarry at Farnum in what appears to be the Connellsville sandstone, on pages 470 and 471 of Vol. IV of the State Survey reports.

J. B. Smith Quarry Near Byron—Connellsville Sandstone.

The Connellsville sandstone has been quarried quite extensively in the region of Byron (Mt. Clare) along Browns creek. In fact, stone from quarries on this ledge in this locality was largely used in the construction of the Hospital for the Insane at Weston, Lewis county, and the Balt. and Ohio Railroad depot at the same place. On page 230 of this report is given a full description of the J. B. Smith quarry, along with a chemical analysis of the stone therefrom.

FORESTS.

Owing to the rapid depletion of the forests of the State by the combined attacks of fire, farmers and saw-mills, the subject of their preservation and reproduction has recently attained an interest second only to the conservation of its mineral fuels. The available supply of timber is rapidly growing less, and should the present rate of exhaustion continue, 20 to 25 years will practically see the end of the virgin forests of West Virginia. A glance at the State Survey map accompanying Vol. V, Forestry and Wood Industries, dated Feb. 1, 1911, will show no large tracts of virgin timber in the Doddridge-Harrison area, the same being represented almost entirely by "farm areas." The latter, as classified by A. B. Brooks, the author of the report and map mentioned, does not necessarily mean that all such areas are under cultivation since almost every farm in both counties has a small wood-lot reserve.

Doddridge County.

On pages 133 and 134 of the above mentioned report, Mr. Brooks gives the following interesting account of the original and present forest conditions, and the lumber industry of Doddridge county:

"**Original Timber Conditions.**—The timbers of the county were the oaks, hickories, walnuts, yellow poplar, white ash, and other hardwoods, all reaching a large size and attaining a high degree of excellence in the rich lands commonly found in all sections. There were small quanties of yellow and white pines, hemlock and red cedar.

"**The Lumber Industry.**—The principal outlets for manufactured lumber have been the Baltimore and Ohio railroad since about 1857, and Middle Island Creek and its larger tributaries.

"Water saw mills on Middle Island creek and its branches were common until within recent years, cutting vast quantities of fine yellow poplar and some other timbers. About 90 per cent of the yellow poplar was sawed and rafted to a chair factory in Marietta, the rest going to Pittsburgh.

"Beginning with about 1880 oak timber was cut and much of it sold in Marietta and in Beverly and Malta on the Muskingum river in Ohio.

"Much timber has been used in oil rigs, thousands of which have been constructed in the county during the past 25 years.

"Large numbers of staves and ties have been floated down Middle Island creek to St. Marys, the ties being sold largely to the Pennsylvania railroad and the staves to manufacturers of oil barrels in Baltimore.

"The timber that has been taken 'has gone down the water courses which liberally supply the county with transportation for timber, or has been hauled to the railroad over tram roads which are numerous and of considerable length, one of them being about twenty miles long, and over which vast quantities of timber have been hauled. In most places where the timber has been removed it has been taken, staves, ties, telegraph poles, hoop poles, and tan bark, all going along with the saw timber, and leaving the land cleared and ready for farming.'

"**The Present Forest Conditions.**—We have a record which says that from a fourth to a third of the timber of Doddridge had not been touched in 1893. At the present time practically all the woodland has been culled. The best timber is now found in West Union, Cove, Central and New Milton districts, where most of the land is held by a comparatively few private owners.

"The woodlots belonging to farmers are very superior to those found in some sections of the State, there being a good second growth and in some cases a virgin stand of timber. It is probable that 65 per cent of the area has been cleared for cultivation and grazing purposes."

Harrison County.

The following interesting account is as published by Mr. Brooks on pages 159-161 of the above mentioned report, in which the same forest features for Harrison are described as for Doddridge county:

"**Original Timber Conditions.**—It is difficult now to find any more than a trace of the original forests. The quality of timber in small isolated areas, however, together with the unusual fertility of the soil and other favorable natural conditions, justify us in asserting that no county in the State had a larger and more uniform boundary of superior hardwoods. Nearly every species of hardwood common to central West Virginia grew here, but those which should be especially mentioned were yellow poplar, white oak, red oak, black walnut, hickory, white ash and sugar maple. There were no soft woods of any consequence.

"**The Lumber Industry.**—The rich and easily cultivated lands of Harrison county invited settlement and the clearing of large areas before the timber had a commercial value. The removal of timber from farms in all sections has made an extensive lumber industry—such as has been carried on in other parts of the State—an impossibility. There were saw mills, it is true, operating along several of the streams in an early day; but these were of the usual primitive type and manufactured lumber in small amounts for domestic use only. An early writer, speaking of the industries of Harrison county, informs us that there were 6 saw mills running in the year 1835.

"Poplar, oak, and some other timbers have been floated out on the West Fork river, going to Pittsburgh, Brownsville, Rices Landing, Beaver and other points along the Monongahela and Ohio rivers.

"Most of the timber not destroyed by the settlers has been sawed by portable mills which have moved from place to place during the last 40 or 50 years. As a rule, the operations have been most numerous and active in the localities made accessible by the building of railroads. According to Haymond's "History of Harrison County" published in 1909, the principal railroads of the county were completed as follows:

"Baltimore and Ohio railroad to Clarksburg in 1856.

"Monongah railroad in 1889.

"West Virginia and Pittsburgh railroad in 1879.

"Short Line railroad in 1901.

"**Present Forest Conditions.**—About 80 per cent of the county has been cleared and is now in a good state of cultivation. The remainder of the area is in woodlots ranging in size from 1 or 2 acres up to 100 acres or more. Woodland is more plentiful on the western edge of the county than in other sections. Mr. R. T. Lowndes, of Clarksburg, mentions a broken tract of about 2,000 acres of culled forest lying on Indian run, a tributary of Tenmile creek in the western part of the county."

CARBON BLACK INDUSTRY.

The manufacture of carbon black has become quite an important industry in the Doddridge-Harrison area, since there are seven or eight plants engaged at that business. According to data furnished by the different concerns, it requires **700 to 800 cubic feet of** natural gas to make **one pound** of carbon black, which in 1910 brought about 6 cents a pound. A brief account will now be given of each plant in the alphabetical order of their names.

Acme Carbon Company.—This plant is located on the south side of the railroad, 0.9 mile east of Smithton, and was established in 1903. According to information given D. B. Reger by John Shewmaker, Supt., the capacity is 4,000 pounds of carbon black daily, requiring 700 to 800 cubic feet of gas to one pound of the manufactured product. Employment is furnished for 6 men. The main office it located at Wheeling, W. Va. Use gas from their own wells.

Castle Brook Carbon Black Company.—This plant is located on the south side of the railroad, 0.6 mile southeast of Smithton, and was established in about 1902 or 1903. According to Harold Engstrom, bookkeeper, employment is furnished for 10 persons, giving the plant a daily output of 150 barrels of 75 pounds each. The product is used for printer's inks and paints. The gas utilized is obtained from their own wells. The main office is located at Williamsport, Pa.

Diamond Carbon Black, J. W. Beacom.—This plant is located 1.5 miles east of Wilsonburg, and was established in 1905. The main office is located at Randolph, New York. The daily capacity is 25 barrels of 50 pounds each. Gas from their own wells is utilized in making the product.

Mt. State Carbon Company.—This plant is located 0.5 mile northwest of Smithton, and was established in 1902. The main office is located at West Union, with S. W. Langfitt, Treasurer. When running full, the daily capacity is 80 barrels, but owing to a shortage of gas at this time (August, 1910) it is only 30 barrels.

Peerless Carbon Black Company.—This plant is located

0.5 mile east from Wilsonburg, and was established in 1901, furnishing employment for 10 men, according to R. E. Sellers, Manager, who refused to give any data as to the amount of gas required to make one pound of carbon black, and the daily capacity of the plant. The gas utilized comes from their own wells.

Raven Carbon Company.—This plant is located at McWhorter in the southern border of Harrison county. The plant runs day and night, furnishing employment for 4 men. No data was obtained as to the capacity of the factory. The gas used comes from their own wells.

Rock Run Carbon Black Company.—This plant is located on the south side of the railroad, one mile northeastward from West Union, and was established in 1905. The main office is located at Warren, Pa. The daily capacity is 8 barrels of 50 pounds each, giving employment for 3 to 5 men.

Southern Carbon Company.—This plant is located one mile northeast of West Union along the Balt. & Ohio Railroad, and was established in 1903. The main office is located at Warren, Pa., with F. M. Knapp, Supt. The daily capacity is 30 barrels of 50 pounds each.

At the special request of the State Geologist, the following interesting paper on the history and development of the carbon black industry has been kindly submitted by Mr. Godfrey L. Cabot, of Boston, Mass., one of the early pioneers of this industry in West Virginia:

The Manufacture of Carbon Black.

By Godfrey L. Cabot.

The most important manufacturing industry of Doddridge County and one of the important manufacturing industries of Harrison County is the manufacturing from natural gas of a species of lamp black, known to the trade throughout the civilized world as Carbon Black.

Carbon Black is the soot of natural gas, collected upon an iron surface and thence removed by some automatic scraping device. The black then falls into conveyor boxes which carry it mechanically to a place where it is raised into bins and thence packed for market.

Carbon Black was first made from artificial gas, in a very small way, for the purpose of preparing a gloss printing ink, more brilliant than could be obtained with any other raw material. The pioneers were Messrs. J. K. Wright & Co., who began this kind of manufacture in Philadelphia about 48 years ago.

In the year 1872, natural gas began to be used by Haworth & Lamb for this purpose at a place called New Cumberland in the northern part of West Virginia, and the first plates were made of soapstone, which, however, were discarded for the use of cast iron, in the shape of flat pans, through which water was circulated.

After the failure of the gas in New Cumberland, this factory was ultimately moved to Dunkirk, Ind., and has long since been broken up for junk. The use of water has proved, on the whole, undesirable, although tried by various different companies and individuals and with various different forms of apparatus.

The next manufacturer in point of time was Mr. Peter Neff, who erected his factory at Gambier, Ohio. Neither of these two original factories ever reached a large output. The black was sold at a very high price and gas at that time was practically worthless throughout the oil and gas regions for any other purpose and gas wells, no matter how large, could be bought for the price of the casing and tubing in them. Nor was there any difficulty in obtaining territory or in protecting what one already had.

In the first decade, from 1872 to 1881, the price of black ranged from $2.50 a pound to about 35 cents a pound, averaging probably about 60 cents a pound. The manufacture was carried on on a small scale and in a manner very wasteful of gas, with comparatively crude appliances and cheap apparatus. In the year 1874, a factory was erected at a place called Saxonburg Station, Pa., now Cabot, Pa., and at this point black was manufactured almost continually until about the year 1907, which is the longest that Carbon Black has yet been made in any one spot. This industry is, of necessity, a migratory industry.

Natural gas is being wasted and run into the air in enormous quantity and of quality suitable for making Carbon Black, at many different points, and to an amount far in excess of all possible requirements of the world for its supply of Carbon Black.

The price has always been kept down by the necessity of competing with cheap gas and as soon as gas has ceased to be very cheap in a given locality, the manufacture has become unremunerative and the factory has been removed perforce.

In these early factories, the plates or surfaces on which the black was collected, were stationary and the car which collected the black was moved back and forth beneath this surface, carrying with it the scraper that scraped the black from the plates.

In the second decade, from 1882 to 1891, most of the factories were erected in Pennsylvania and various new mechanical devices came into use and, in particular, revolving plates, some of which were 24 feet in diameter and some only 3 feet, turning over stationary burners and scraper box and stationary plates beneath which the burner and scraper box revolved and rollers revolving over a row of burners and a scraper.

The price of black went steadily down and the price of gas increased and the average price was perhaps 12 cents a pound during this decade.

Some manufacturers, attracted by the immense fields of gas in Indiana, were induced to build factories in Indiana, of which only

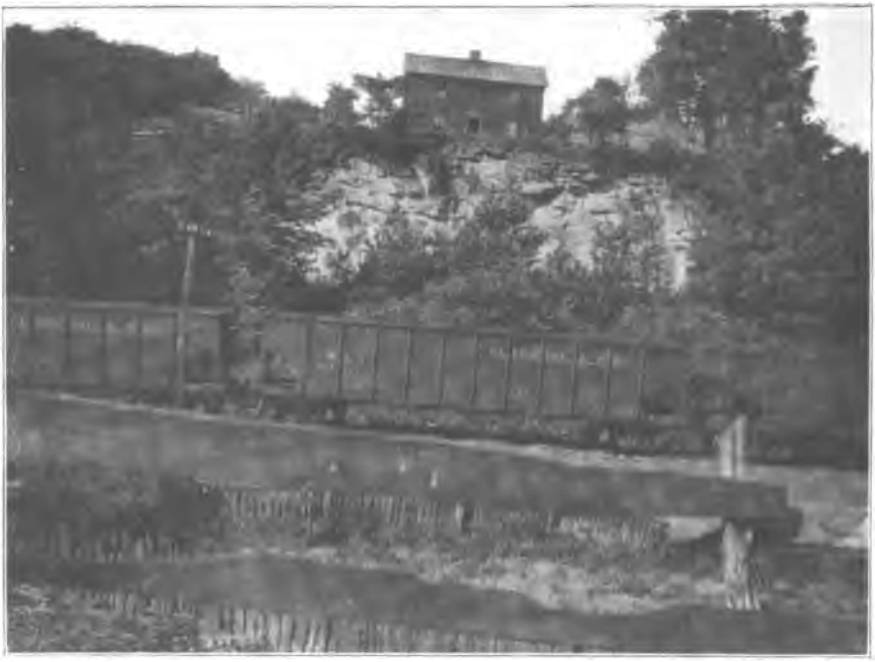


PLATE XXV (a).—Wagner Quarry in Connellsville Sandstone, near Byron, Harrison county.

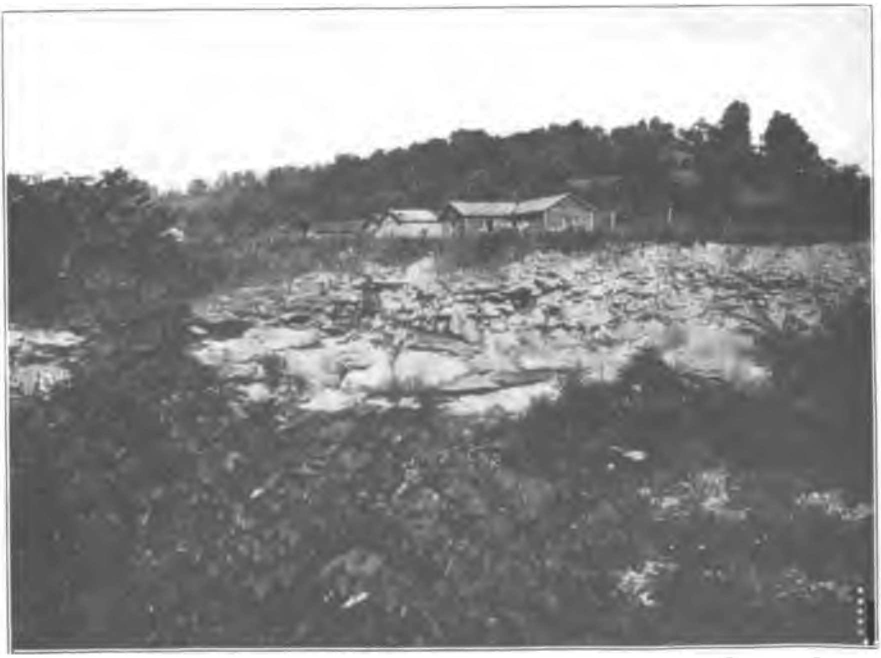


PLATE XXV (b).—Smith Quarry in Connellsville Sandstone, near Byron, Harrison county.

one was profitable, that owned by the Davis Brothers, at Eaton. Four other enterprises in this field were unprofitable for various reasons, one of which was the very poor quality of the gas for this purpose, the yield and quality being far inferior in proportion to the amount of gas to what was obtained in Pennsylvania.

In the third decade, from 1892 to 1901, the manufacture in Pennsylvania greatly increased and the industry sprang up again and on a much larger scale in its birth-place, West Virginia. The principle of reciprocating surfaces, that is, the carbon black collecting surfaces, oscillating back and forth over the burners and scrapers, was introduced and became very successful. The factories in which the black box was run back and forth with cables, one after another fell out of commission. Various modifications of the various principles already mentioned, came into use. Factories sprang up on Tug River in West Virginia and at Grantsville, W. Va., and quite a family of factories in the vicinity of Weston and another group in the vicinity of West Union, the County Seat of Doddridge County. The factories near Weston and near West Union were built largely during the 4th decade, from 1902 to 1911.

The average expense of obtaining gas was probably not much more than in the previous decade, owing to the removal of the factories from the greatly weakened fields of Pennsylvania to the fresh and prolific fields of West Virginia, but the price of black further declined and probably averaged less than 6 cents during the third decade, and less than 5 cents during the fourth decade.

We now come more particularly to the factories in Doddridge and Harrison counties. These number at the present time, five factories in Doddridge County and three in Harrison County, all lying along the line of the Baltimore & Ohio Railroad between Parkersburg and Clarksburg. Starting with the west, you come first to the Rock Run and Southern Carbon Company factories, about half way between West Union and Smithburg. These factories are built on the principle of the reciprocating bench, which moves back and forth with a reciprocating motion.

Next as you go east, you reach the Mountain State Carbon Company factory, in which the black is made on stationary plates of channel beams and the scraper oscillates by a reciprocating motion between the burners and the collecting surfaces.

You then pass Smithburg and reach the factory of the Castle Brook Carbon Company, which was at one time the second largest in the world, but of which a part has been moved away, owing to the increased expense of obtaining gas. Here, also, the black is made on long benches.

Next you come to the factory of the Acme Carbon Company, in which the black is made on plates 3 feet in diameter, revolving above the scrapers and the burners. As you go farther east, the next factory encountered is that of the Bristol Oil & Gas Company, near Bristol, W. Va., the smoke of which can just be seen for a moment as you pass at a distance of half a mile or so on the railroad. In this factory the black is made on the under-surface of hollow channel cast iron benches, which are cooled by an air blast. This is the only factory at present operating with artificial cooling, although there is still in existence, though not running, a factory, operated with water-cooling at Hallton, Pa.

The black in the Bristol factory is collected in reciprocating black boxes, carrying a scraper and discharging at one end of the building into hoods from which the black is withdrawn by a screw conveyor and subsequently elevated and packed.

Next going east, you reach close to the station of Wilsonburg the factory of the Peerless Carbon Company, who make their black on rollers, revolving over the gas jets from which the flames impinge upon the bottom of the rollers. Their black commands a higher price for a certain quality of printing ink and the factory has an importance quite out of proportion to its output.

The furthest east of all the factories in these two counties is the plant of Mr. J. W. Beacom. ¼ mile or so east of Wilsonburg, which is very similar to the process used at Bristol, but the benches are narrower, the yield much less in proportion to the gas and there is no air-cooling.

All of these factories in Doddridge and Harrison counties consist essentially of a number of rectangular buildings of sheet iron, from 40 to 60 feet long and from 20 to 30 feet wide, containing the black-making machinery, screw conveyors to carry the black from these various different buildings to a central packing-house and of the packing house, warerooms, etc., therewith connected.

Besides the factories above named, plants have been recently built at Clendening, Creston, Nancy's Run, Weir, Chapmanville, Goose Neck, W. Va., and at Henrietta, Okla. Also a second plant near Grantsville, W. Va.

It is become more and more the practice in the manufacture of Carbon Black to obtain supplies either from low pressure gas wells which are unavailable for the purposes of the large gas companies, or to collect the gas over a wide area from oil wells where the gas is wasting in the open air and would otherwise be a total loss. Such gas costs the manufacturer more than what he formerly obtained by drilling his own wells in the immensely prolific fields of high pressure gas which formerly existed, but it is more advantageous for the community that this high pressure gas or such of it as is left, should be chiefly utilized for other purposes and only that used for Carbon Black manufacture which would not otherwise be applied to any useful purpose.

GODFREY L. CABOT.

Boston, Mass., April 22, 1912.

thawing, and where it is practicable fall and winter plowing is advisable. The average date of last killing frost in spring is April 29 and of the first in autumn October 2. Frosts may occur as late as the latter part of May, but this is unusual. The season is always long enough to mature all the crops grown.

The mean annual rainfall amounts to 43.5 inches, and varies little either way from this average for the wettest and driest years, as is shown in the table. The early part of the growing season has the heaviest rainfall, which lasts usually until cultivated crops have reached maturity. In the late summer and fall months the precipitation is considerably less and droughty conditions often prevail, making it difficult to get fall-sown crops, such as grains and grasses, started.

Normal Monthly, Seasonal, and Annual Temperature and Precipitation at Lost Creek.

Months	Temperature			Precipitation			
	Mean.	Absolute maximum	Absolute minimum	Mean,	Total amount for the driest year.	Total amount for the wettest year.	Snow average depth.
	°F.	°F.	°F.	Inches.	Inches.	Inches.	Inches.
December	34	71	— 7	3.7	2.5	2.4	5.2
January	34	70	—20	3.1	2.5	5.6	6.4
February	28	80	—35	3.5	6.5	1.9	5.5
Winter	32	....	....	10.3	11.5	9.9	17.1
March	44	81	— 1	4.6	6.6	7.5	6.2
April	51	91	2	3.3	4.0	2.9	1.8
May	62	93	25	4.2	3.2	4.1	0.0
Spring	52	....	....	12.1	13.8	14.5	8.0
June	69	97	36	4.1	4.2	1.8	0.0
July	73	99	40	5.7	2.4	4.5	0.0
August	71	97	41	3.6	2.1	9.3	0.0
Summer	71	....	....	13.4	8.7	15.6	0.0
September	66	97	31	2.8	1.6	2.3	0.0
October	55	91	18	2.0	2.2	4.9	T.
November	44	78	3	2.9	2.9	2.6	1.6
Fall	55	....	....	7.7	6.7	9.8	1.6
Year	53	99	—35	43.5	40.7	49.8	26.7

Average date of last killing frost in spring, April 29, and of first in autumn, October 2.

Normal Monthly and Annual Temperature and Precipitation at Central Station.

Month.	Temperature.	Precipitation.	Month.	Temperature.	Precipitation.
	°F.	In.		°F.	In.
January	32.7	3.32	August	72.0	2.97
February	29.1	3.06	September ...	66.8	2.75
March	43.8	3.31	October	54.8	2.29
April	50.5	....	November	41.8	2.68
May	62.3	3.53	December	33.1	3.38
June	69.8	4.26			
July	73.7	4.24	Year.......	52.5	3.25

Mean Temperature at Central Station[1], Doddridge County.

(Record kept by Mr. G. W. Sherwood.)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.	Avr. for Year
1893	....	37.2	44.2	58.0	66.2	77.0	80.0	74.4	68.4	56.0	41.4	39.2	....
1894	37.5	35.1	....	50.6	63.2	73.7	74.5	73.6	67.9	....	....	....	....
1895	....	21.2	....	52.0	59.9	73.0	70.1	70.1	71.3	....	....	....	....
1896	....	....	....	....	....	....	....	....	....	....	....	....	....
1897	....	....	....	....	....	....	....	....	....	....	....	....	....
1898	....	....	....	....	....	....	....	....	....	....	....	....	....
1899	....	....	....	....	....	....	....	....	....	56.6	44.9	33.0	....
1900	34.6	30.2	37.2	51.2	62.6	70.6	74.3	76.0	71.4	60.6	42.9	33.4	53.8
1901	32.8	25.6	42.4	46.4	60.8	70.2	77.2	72.9	63.8	53.7	37.4	31.0	51.2
1902	29.1	25.0	42.9	48.6	64.0	66.7	74.3	68.8	63.6	57.0	49.3	33.4	51.9
1903	23.6	32.7	51.0	50.0	64.4	64.5	72.2	....	64.8	53.8	37.8	25.4	49.1
1904	26.1	28.6	43.5	47.4	61.6	69.2	70.8	69.9	66.8	53.6	39.8	31.8	50.8
1905	24.4	24.1	45.5	51.2	62.9	69.8	73.1	71.0	64.8	53.4	40.8	35.1	51.3
1906	37.0	30.6	35.7	52.6	61.9	70.1	71.6	75.2	69.0	54.3	42.5	35.0	53.0
1907	36.8	29.8	49.3	44.8	57.7	65.0	71.2	68.2	65.2	48.8	39.5	34.0	50.9
1908	29.2	30.6	46.3	52.9	62.9	67.9	73.2	69.6	65.1	53.4	41.2	34.6	52.2
1909	35.4	38.0	39.1	52.5	59.8	70.6	69.1	69.0	59.6	47.8	48.2	26.4	51.3
1910	29.6	29.6	47.8	50.6	55.4	70.0	71.4	69.0	67.4	56.4	....	26.2	....
1911	35.0	37.0	38.8	47.8	64.2	70.0	72.1	72.6	67.8	52.8	....	37.4	....
Means	31.6	30.4	43.4	50.4	61.8	69.9	73.0	71.4	66.5	54.2	42.1	32.6	52.3

---

[1] The climatological data for Central Station and Lost Creek was kindly furnished the State Geological Survey by H. C. Howe, Director of the W. Va. Section of the Weather Bureau, U. S. Dept. of Agriculture, Parkersburg, W. Va.—R. V. H.

Monthly Precipitation at Central Station, Doddridge County.

(Record kept by Mr. G. W. Sherwood.)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1891	2.60	....	....	....	....	....	....	....	....	1.68	1.57	....	....
1892	....	....	....	....	....	4.37	7.20	1.94	2.91	1.11	4.07	2.59	....
1893	3.92	6.70	1.48	5.70	3.37	4.18	3.86	4.90	2.48	4.66	2.62	2.17	46.04
1894	4.09	3.57	2.50	2.68	4.02	4.15	0.65	2.64	2.42	1.90	2.97	4.14	35.73
1895	....	....	2.39	2.10	0.79	2.62	3.68	1.44	....	....	....	....	....
1896	....	....	....	....	....	....	....	....	....	....	....	....	....
1897	....	....	....	....	....	....	....	....	....	....	....	....	....
1898	....	....	....	....	....	....	....	....	....	....	....	....	....
1899	....	....	....	....	....	....	....	....	....	1.68	1.57	3.11	....
1900	2.60	3.77	3.37	1.08	3.41	4.60	5.30	2.09	0.55	1.78	4.87	1.76	35.18
1901	2.00	0.61	3.36	0.86	5.26	4.29	3.87	3.91	4.23	0.78	2.81	4.67	44.67
1902	3.45	2.08	3.00	3.47	2.98	6.99	4.13	2.36	3.68	1.44	3.29	5.64	42.51
1903	2.09	6.48	4.00	4.84	5.23	4.22	3.70	2.50	2.05	3.00	3.51	2.17	43.79
1904	2.27	1.92	3.37	2.56	1.99	6.07	2.78	1.69	1.65	1.19	0.36	3.37	29.22
1905	3.19	2.20	3.89	2.63	4.27	2.86	3.56	4.30	2.79	7.02	3.57	3.51	43.79
1906	3.60	1.40	3.98	3.18	2.00	4.58	3.32	4.72	2.76	1.86	2.34	4.51	38.25
1907	7.94	1.77	3.09	2.73	3.28	4.54	7.22	4.32	6.88	2.50	3.24	3.51	51.02
1908	2.11	3.16	5.30	3.33	5.72	1.93	5.79	1.82	0.59	1.49	0.80	2.80	34.84
1909	3.17	5.14	2.43	....	5.71	6.47	3.07	4.84	2.77	2.03	0.89	2.17	....
1910	6.50	3.51	0.19	2.67	4.75	2.52	3.84	2.95	4.79	1.46	2.22	2.24	37.63
1911	4.09	1.22	2.19	3.47	1.64	1.92	3.53	7.72	4.55	5.28	2.05	1.79	39.55
Means	3.57	3.11	2.97	2.95	3.63	4.14	4.09	3.38	3.01	2.40	2.51	3.13	38.89

Monthly Snowfall at Central Station, Doddridge County.

(Record kept by Mr. G. W. Sherwood.)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1893	15.0	3.0	6.0	T.	....	....	....	....	....	....	0.9	0.2	....
1894	....	19.0	....	T.	....	....	....	....	....	....	....	14.0	....
1895	....	....	....	....	....	....	....	....	....	....	....	....	....
1896	....	....	....	....	....	....	....	....	....	....	....	....	....
1897	....	....	....	....	....	....	....	....	....	....	....	....	....
1898	....	....	....	....	....	....	....	....	....	....	....	....	....
1899	....	....	....	....	....	....	....	....	....	....	T.	5.0	....
1900	3.0	10.5	11.8	T.	....	....	....	....	....	0	5.0	0.2	....
1901	9.0	3.0	2.0	T.	....	....	....	....	....	0	5.0	4.5	....
1902	11.5	3.8	13.5	11.0	....	....	....	....	....	0	0.2	11.0	....
1903	7.3	7.0	T.	T.	....	....	....	....	....	0	2.9	9.2	....
1904	9.6	8.8	2.0	2.0	....	....	....	....	....	0	T.	9.2	....
1905	20.0	5.5	1.0	T.	....	....	....	....	....	0	T.	2.3	....
1906	6.5	6.5	14.0	T.	T.	....	....	....	....	1.5	1.0	3.8	....
1907	5.2	8.0	1.0	4.0	....	....	....	....	....	T.	T.	6.0	....
1908	6.2	5.2	2.0	T.	....	....	....	....	....	0	4.5	5.2	....
1909	8.5	2.0	T.	T.	T.	....	....	....	....	T.	T.	10.5	....
1910	18.0	14.5	T.	1.0	....	....	....	....	....	0	....	12.8	....
1911	8.0	3.8	1.0	1.0	....	....	....	....	....	0	....	T.	....
Average	9.8	7.2	4.2	1.4	T.	....	....	....	....	0.1	1.6	6.4	30.7

Mean Temperature at Lost Creek, Harrison County.

(Record kept by Mr. Allen Smith.)

Year	Jan.	Feb	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov	Dec.	Avr. for Year
1897	....	....	....	....	....	....	....	68.6	64.3	56.2	43.4	37.4	....
1898	37.6	31.6	48.7	48.8	61.2	70.4	75.2	72.9	67.3	54.6	40.4	32.8	53.5
1899	33.4	25.4	43.4	52.2	62.9	70.5	71.4	72.8	63.2	55.1	45.1	32.8	52.4
1900	34.4	31.0	37.3	50.5	61.0	69.2	71.8	75.3	68.2	60.4	49.4	32.1	53.4
1901	34.0	25.6	42.3	45.8	59.8	70.8	77.9	72.0	64.0	53.1	36.3	31.2	51.1
1902	29.9	24.6	42.9	48.6	63.9	66.0	73.4	66.9	63.4	56.4	48.8	33.5	51.5
1903	32.0	32.6	50.6	50.4	62.6	62.9	70.5	69.2	62.4	52.7	37.4	26.6	50.8
1904	25.4	29.4	43.2	42.9	59.4	67.2	....	69.6	66.5	56.6	37.0	28.4	....
1905	22.7	24.6	43.2	49.4	62.4	67.4	71.8	69.4	64.2	52.3	40.1	35.1	50.2
1906	40.0	31.8	38.4	53.8	62.1	70.4	72.0	76.0	70.0	54.6	43.7	36.6	54.1
1907	39.0	31.2	50.4	45.2	58.0	64.6	72.2	68.5	65.6	49.0	40.6	35.1	51.6
1908	30.8	31.5	47.7	54.0	62.6	68.0	73.8	70.7	65.6	53.6	42.2	35.8	53.0
1909	37.8	40.3	40.3	52.1	66.0	70.4	70.0	70.9	64.4	49.6	49.1	28.8	52.8
1910	32.6	32.4	49.2	52.7	56.7	66.0	73.7	70.2	67.4	58.0	36.2	28.4	52.0
1911	37.2	37.8	39.8	48.2	64.0	69.4	72.0	74.1	67.7	55.4	38.8	38.0	53.5
Means	32.6	30.7	44.1	49.6	61.2	68.1	72.7	71.1	65.6	54.5	41.9	32.8	52.1

Monthly Precipitation at Lost Creek, Harrison County.

(Record kept by Mr. Allen Smith.)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1896	1.39	2.47	4.07	3.18	4.43	5.53	14.10	2.20	4.90	1.59	2.85	1.97	48.68
1897	1.85	4.65	3.21	3.22	3.54	4.07	7.03	3.59	0.49	0.31	3.78	4.87	40.61
1898	5.55	1.92	7.50	2.93	4.07	1.77	4.47	9.33	2.89	4.89	2.59	2.37	50.28
1899	5.51	4.28	5.59	1.79	6.00	4.17	6.31	2.39	3.37	0.88	2.79	3.75	46.83
1900	2.93	4.79	3.67	1.39	3.08	4.65	4.61	2.50	0.75	3.90	2.54	1.70	36.51
1901	2.13	0.62	3.06	7.48	5.56	2.50	3.33	4.56	3.75	0.12	2.96	5.38	41.45
1902	3.15	2.61	3.07	2.76	6.47	6.55	3.27	2.01	4.80	2.37	2.75	6.88	43.69
1903	2.61	6.51	6.59	4.00	3.17	4.21	2.40	2.14	1.65	2.33	2.91	2.46	40.88
1904	4.26	3.37	3.88	4.39	3.95	4.54	2.00	1.91	0.43	1.80	0.26	2.77	33.56
1905	3.35	2.27	6.34	3.10	7.70	3.41	4.14	4.06	2.43	6.30	2.57	3.36	49.03
1906	4.36	2.33	5.51	5.21	3.12	5.20	2.80	6.45	3.51	1.64	3.02	4.74	47.89
1907	8.04	2.73	4.10	1.97	4.87	3.97	8.68	6.27	3.22	2.34	3.52	4.03	53.74
1908	1.91	3.83	7.73	3.74	9.30	2.72	2.97	3.35	1.21	1.15	1.09	2.86	41.86
1909	3.27	4.50	2.88	5.48	3.39	7.88	5.52	4.03	2.94	3.28	0.93	2.36	46.46
1910	6.32	2.43	0.28	1.66	4.13	3.51	3.99	4.07	5.16	1.55	1.84	2.04	36.98
1911	4.72	1.09	3.10	4.16	0.40	3.88	1.75	8.08	6.15	4.76	2.09	3.27	43.45
Means ...	3.83	3.15	4.41	3.53	4.57	4.27	4.84	4.18	2.98	2.45	2.41	3.43	44.05

Monthly Snowfall at Lost Creek, Harrison County.

(Record kept by Mr. Allen Smith.)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1896	....	....	19.5	0	0	....	....	....	....	0	0	T.	....
1897	3.0	....	1.5	0	0	....	....	....	....	0	0	5.0	....
1898	3.5	3.0	0	3.0	0	....	....	....	....	0	3.8	10.5	....
1899	8.8	12.0	3.5	1.0	0	....	....	....	....	0	T.	3.0	....
1900	3.0	5.0	10.0	T.	0	....	....	....	....	0	2.0	T.	....
1901	10.0	2.4	2.5	0	0	....	....	....	....	0	5.2	3.0	....
1902	10.8	2.8	12.2	10.0	0	....	....	....	....	T.	T.	10.5	....
1903	5.5	7.5	T.	T.	0	....	....	....	....	T.	1.5	9.5	....
1904	5.0	6.3	2.0	2.0	0	....	....	....	....	0	T.	6.5	....
1905	20.0	....	0	0.5	0	....	....	....	....	0	T.	2.0	....
1906	4.5	9.0	16.5	T.	T.	....	....	....	....	T.	1.5	1.5	....
1907	3.0	6.5	1.0	2.0	0	....	....	....	....	0	T.	3.0	....
1908	8.5	4.0	1.0	T.	0	....	....	....	....	0	4.5	6.0	....
1909	4.0	2.5	T.	2.0	T.	....	....	....	....	0	T.	6.8	....
1910	9.8	13.0	T.	0.5	0	....	....	....	....	1.0	1.5	9.2	....
1911	3.5	4.8	0.8	T.	0	....	....	....	....	0	T.	0.5	....
Means	6.8	6.1	4.4	1.3	T.	....	....	....	....	0.1	1.2	4.8	24.7

AGRICULTURE.

The early settlers paid little attention to agriculture. Their main food crop was corn, of which they tried to produce a sufficient quantity for home consumption.

Live-stock raising dates back to the settlement of the region, sheep being bred for wool and cattle for beef and tallow. The stock were turned loose to forage for themselves and found abundant sustenance in the wild pea vines growing in the woods.

Sheep raising proved particularly profitable to the early settlers, climatic conditions being favorable and the output easily and conveniently marketed at points outside the area. Cattle were sold at outside markets on the hoof, Baltimore taking most of the output of the region. By 1890 this industry had grown to a considerable volume, lambs being shipped extensively to outside markets, in addition to wool and beef.

The development of agriculture was slow, keeping pace with the extension of the settlements. No effort was made to maintain the productiveness of the fields, which when exhausted were soon seeded naturally to bluegrass, m excellent pasture.

The growing of small grains had acquired consid importance by 1870, wheat, oats, and rye being the mo portant crops. This continued up to 1900, although the increase in population made the output barely sufficie home consumption.

Tobacco was grown to the extent of 17,098 pour Harrison county and 17,568 pounds in Doddridge c according to the census of 1870, most of which was for consumption. Since that time its cultivation has gra decreased, except for small patches.

The development of the oil and gas resources of th counties, which began soon after 1890, has taken much tion from the farms. The labor has gone into this fie owners of lands have curtailed their farming operatio pending more upon the royalties and rentals they r which far exceed farm profits. The agriculture of th counties may be said to be practically at a standstill. exhaustion of some of the oil and gas deposits has m necessary for many to return to their farming. Agri is confined at present to the staple crops in the valle pasture lands on the steep hillsides. Corn is the stapl of both counties, but its production is not equal to quirements of the farms. Wheat and oats are grow production, according to the census of 1900, being high ever before. The census of 1870 shows some buckwhe no mention of this crop is made in subsequent reports present production is limited to a few scattered p The acreage in grasses for hay is slightly greater th used for corn in Doddridge county, while in Harrison the acreage in grass is more than twice that given t In Doddridge county the average yield of hay is sh the Twelfth Census to be 1 ton to the acre. In H it is somewhat larger, owing to the better adaptation limestone soils and of the bottom-land types influen these soils to the grasses. Timothy is the principal gr for hay, although clover is often grown with it. Som grass is also cut. The acreage in permanent pastures given, but is relatively high, as the larger part of the cleared hilly lands are used for grazing. Bluegrass seeds naturally on most of the soils, but does particularly well on the limestone land, the Westmoreland silty clay loam, and the red areas of the Upshur clay. Upon the other soils derived from gray and brown shales and sandstones bluegrass does not do so well, its life being short, on the average not more than 10 years. At the end of this period it is generally necessary to return to cultivated crops and then reseed. When the bluegrass begins to run out the native wild grasses and broom sedge come in, and while these make pasturage they are much less valuable than bluegrass.

On the limestone lands in Harrison county the bluegrass holds better and grazing cattle is the most important part of the agriculture. The comparatively large extent of the limestone lands in Harrison county has made it one of the leading grazing counties of the State.

Until quite recently the cattle were practically all of grade stock. Progressive cattlemen have recently introduced improved strains of the Hereford and Shorthorn breeds, the former being the most popular. Besides the stock raised on the farms, considerable numbers are brought in from outside sections. Pocahontas county supplies the greater part of these, but some are obtained from Ohio and even from the West. Where young cattle are taken they are fed through the winter months on the hay cut on the farm and with grain. One to two seasons put the cattle in prime condition. Those not used for local consumption are shipped to Pittsburgh or Baltimore markets and even exported to Europe.

Every farmer keeps cows for the home supply of milk and butter, and there are numerous dairies around Clarksburg, which are inadequate to supply the local demand. The Jersey is the favorite dairy breed, though there are some Holsteins. The latter are gradually displacing the grade stock.

Sheep are to be found scattered over the county a few on a farm, there being no large flocks. The object is production of spring lambs. The rough lands are better adapted to sheep than to larger animals. Sheep raising is said to be profitable and an extension of the industry would seem to be warranted. The objection to sheep is that they crop the grass too closely. This could be remedied by giving flocks a larger range. The droppings of the sheep do much to fertilize the pastures. No particular effort is made to maintain a certain breed. The Cotswold and Shropshires are most common.

Hogs are raised on most farms, but not more than enough to supply the family needs for pork and lard.

Rotation of crops is not strictly followed, except on the uplands, where the pastures are givinig out and it is desired to reseed them. The steep slopes can not be kept for any length of time in cultivated crops on account of washing. Where sod land is plowed the roots will hold the soil for two corn crops, which should be followed either by wheat or oats, sown with timothy and clover or bluegrass. The hay crop is cut as long as the yields warrant it, and in the meantime the bluegrass has come in and the land is turned to pasture. In harvesting the hay crop the hay is put into small stacks at convenient points in the fields and fenced around so that cattle can be pastured. A great waste of hay results from exposure to the weather. Rarely are there hay barns or sheds on the farms.

On the slopes contour cultivation is necessarily followed. There are many hillsides where the shelf lands are in cereal crops, while the steeper slopes are under grass. This is a practice to be commended.

The manure made on the farm is applied generally to the valley fields very rarely being used on the upland slopes. Grass lands very rarely receive any fertilization.

A few years ago commercial fertilizers were used for the different crops, but the practice has been discontinued entirely. Pastures could be greatly improved and rejuvenated by applications of phosphatic fertilizers and some form of lime. Applications of ground phosphate rock (floats) and slag, as well as acid phosphate, would much improve the soil, while frequent applications of finely ground limestone would prove of great benefit.

In fields so situated as to make the hauling and application of barnyard manure difficult, green manuring is recommended. The best crops for this purpose are the legumes, which include clover, vetch, cowpeas and soy beans. There is little or no attempt on the part of the farmers to make or save barnyard manure.

There has been little change for a number of decades past in the size of the farms in the two counties. The average in Harrison county is 116.7 acres and in Doddridge county 107.6 (Twelfth Census). It is further shown from the same source that in Harrison county 81.5 per cent of the farms are operated by the owners and in Doddriddge county 75.7 per cent. Renting is not a common practice, the terms of rental varying with circumstances.

Under present conditions little farm labor is required, except at harvest time. Labor is scarce and commands high wages, owing to the demand for hands in the oil and gas fields. The coal mines and unskilled labor of the mills do not draw upon the farms, as this work is all done by immigrants, who seldom go to the farms. Not only have land values risen because of the presence of oil or gas or workable seams of coal, but even the ground leases have increased. Values range from $10 for rough, hilly farm to $100 and more an acre for the desirable farms.

As has been intimated previously, the sale of coal rights and the royalties and rentals for oil and gas rights have put many of the landowners in easy financial circumstances. The result is that good houses are being built even in most remote sections and the surroundings generally improved, resulting in an appearance of prosperity often not at all in keeping with the character of the land.

While interest is largely centered on the development of the mineral resources, there is ample opportunity for successful agriculture along a number of lines. As so much of the land is best suited to grazing, this industry should be developed. Effort should be made to improve the pastures, which, with an increase in grain crops, would enable more cattle to be kept on the same land, while the area of the pastures should be extended wherever practicable. Sheep raising, with lambs for market, could also be more generally taken up. The local demands for dairy products would warrant the further extension of dairying, especially near the towns and mines. Poultry raising would for some be a profitable venture. Vegetables are in such demand that trucking could be profitably specialized. Considerable development could be made along this line without affecting the market. The terrace soils along the West Fork river in the vicinity of Clarksburg and below near the mining settlements are suitable for truck crops. Small fruits would also succeed on these soils and would find a ready market.

There is also an opportunity for commercial orcharding in the area, particularly in the production of apples, on the accessible hillsides. The trees must be carefully tended and spraying would be necessary. Eastern and northern exposures should be selected.

Finally, but not the least in importance, there is opportunity for successful and profitable forestry. Much of the rougher lands could be reforested and handled systematically. The growing of locust for posts may be suggested as a profitable source of income. This tree grows everywhere on the hillsides. The original forest growth was removed rather destructively and comparatively little revenue obtained, but from the present forested areas and those that might and should be reforested a considerable income may be expected in a reasonable time.

SOILS.

Exclusive of areas of rough stony land, 11 types of soil were encountered in Harrison and Doddridge counties. These may be divided into two classes according to origin—residual soils and transported or sedimentary soils. The first named include the upland types and the transported or sedimentary soils the first-bottom and terrace soils of the valleys.

The residual upland soils cover approximately 90 per cent of the area surveyed. They are largely of a silty texture on the surface, with clay loam, silty clay loam, and clay beneath. Texturally they are all very similar, the difference being largely in color and agricultural value, as determined mainly by the kind of rocks from which they are derived and by their general topography.

The rock formations, of carboniferous age and sedimentary origin, comprise a great variety of shales, sandstones and limestones, carrying seams of coal. The materials forming these rocks were laid down horizontally, but with the uplifting of the land the beds were folded or arched. Subsequent erosion of these folds has exposed in different places sections of the different strata aggregating over 2,000 feet. The formations have been separated and correlated. They form the upper three of the five geological divisions of the Upper Carboniferous. From the top of the most recent stratum downward they are, in order of succession, the Dunkard, Monongahela and Conemaugh.

The Dunkard series has an estimated thickness of 1,135 feet, and its outcrop covers all of Doddridge and the western part of Harrison county. It is composed of a series of gray and brown shales and sandstones, in which thin beds of red shales and shaly limestones occur.

The weathering of the Dunkard series of rocks gives rise to three soil types. The principal type is the Meigs clay loam, the most extensive soil in the area. Owing to the number of rocks entering into its formation, this type is variable in character, including grayish, light-brown, and Indian-red soils. Areas of the Indian-red clay, which is derived from red shale, where large enough to map, were separated under the name of Upshur clay.

The intermingling of the red Upshur material with the grayish soil derived from the lighter-colored shales and sandstones constitutes one of the conspicuous variations in the Meigs clay loam. The topography of the Meigs clay loam is in the main steep and broken, making the type useful for little but grazing and forestry.

The Dekalb silt loam occurs on the level tops of ridges and their spurs. This type is derived from sandstones and some shales which have resisted weathering to the extent of standing usually as the caps of ridges. Areas of the Dekalb silt loam are found over the Monongahela and Conemaugh formations as a result of like conditions. The soil is one of only ordinary productive power, and rather poorly adapted to grass.

In the western part of Doddridge county there occurs a type—the Upshur silt loam—which differs from the Dekalb silt loam in having a red clay stratum in the lower subsoil. This represents material derived from red shale.

The strata of the Dunkard series rise gradually to the east in the eastern portion of the area and have been eroded sufficiently to uncover the formations included in the Monongahela and Conemaugh. The upper part of the Monongahela is of the same character as the Dunkard; that is, it consists of gray and brown shales and sandstones with some interbedded red shales. These strata give areas of the Meigs clay loam. They occupy the sharp, wooded peaks of the hills and ridges in the limestone sections of Harrison county. Only the upper 100 feet of the Monongahela formation is of this character. The remaining 280 feet, as well as the upper part of the Conemaugh formation, consist largely of interbedded limestones and calcareous shales, giving rise to the limestone lands of this section of the State. The material, which is predominantly silty, has been given the name Westmoreland silty clay loam.

The Conemaugh outcrops occur only in the eastern part of Harrison county, where they are brought to the surface by the Chestnut Ridge anticline or fold. The total thickness of the outcrop is 495 feet.

Below the Clarksburg limestone, which represents essentially the base of the interbedded limestone, shale and sandstone strata giving rise to the Westmoreland soil, the limestones and red shales are thin and unimportant, so that the soil is largely the weathered product of gray and brown shales and sandstones. These represent the Dekalb silty clay loam, a grayish clay loam to silty clay loam, underlain by light-yellow clay loam or clay.

Along the West Fork river and its tributaries flat eroded terraces are developed. These are occupied by two distinct soil types—the Elk silt loam and the Tyler silt loam. Although of relatively small total area, these soils are valuable agricultural types. It is believed that the material giving rise to these soils was deposited by water impounded by ice dams. With the removal of the ice barriers the streams began to cut deeper channels, and erosion became active over the terraces. As a result the terraces in some places now stand 150 feet above the stream level. In many places they have suffered from erosion sufficiently to be quite rolling in character. The material entering into the composition of these soils is derived largely from the Westmoreland silty clay loam.

The important difference between the Elk silt loam and the Tyler silt loam is one of drainage. The latter has the poorer drainage and is slightly lighter colored, with a tendency to mottling. The subsoil is also more plastic. The Elk silt loam is quite similar in general appearance to the Dekalb silt loam, but differs in that it is sedimentary in origin and a more productive soil. In places some residual material from the underlying rocks, principally shale and sandstone enters into the composition of the lower subsoil. Limestone also occasionally underlies this type.

Along Middle Island creek, its tributaries, and a number of other streams in that portion of the area outside the limits of the Westmoreland silty clay loam is developed a terrace soil quite similar in general appearance and topography to the Elk silt loam. The material of this soil, the Holston silt loam, is derived largely from the Dekalb and Meigs soils. The type is less productive than the Elk silt loam, as would be expected, since limestone material does not enter into its composition.

Narrow first bottoms are found along all the creeks and stream branches of the area. They are of alluvial origin. being transported sediments deposited over flood plains of the streams during overflows. These first-bottom soils are influenced to a greater or less extent by the wash from the adjoining upland slopes. Where the materials are markedly affected by wash from the red shale soils, the soil has a reddish color. Such areas were classified as the Moshannon silt loam. This type occurs along the streams in Doddridge and western Harrison counties. The other first-bottom type is the Huntington silt loam, a brownish soil consisting largely of material washed from the lighter colored upland soils. Both these alluvial types are strong soils.

The rough stony land includes areas too steep and stony to cultivate. Numerous rock outcrops, particularly of sandstones, are included under this head.

The following table gives the names and areas of the several soil types shown on the accompanying map:

Areas of Different Soils.

Soil.	Acres.	Per cent.
Meigs Clay loam	272,320	54.5
Westmoreland silty clay loam	102,080	20.4
Dekalb silty clay loam	56,488	11.1
Elk silt loam	17,920	3.6
Moshannon silt loam	15,488	3.1
Upshur clay	14,080	2.8
Huntington silt loam	10,816	2.2
Rough stony land	4,480	0.9
Holston silt loam	2,048	.4
Upshur silt loam	2,048	.4
Dekalb silt loam	1,792	.4
Tyler silt loam	1,280	.2
Total	499,840	....

Meigs Clay Loam.

The Meigs clay loam is not a uniform soil type, owing to the fact that a variety of rocks enter into its formation and that the steeply rolling surface in many places has favored the commingling of soil materials of different colors and textures. The surface soil of the Meigs clay loam, which is 4 to 8 inches deep, varies in texture from a silt loam to silty clay loam and in color from a grayish brown to light brown, shading to light yellow with depth. The subsoil ranges from a brownish-yellow, moderately compact silt loam to silty clay loam, grading usually into clay at about 20 inches, which texture usually persists throughout the remainder of the soil profile. The lower subsoil often becomes noticeably heavier and plastic with depth. Where erosion has been especially active the clay is found nearer the surface.

The type includes many patches of Indian-red or reddish clay loam or silty clay loam, underlain by a stiff, plastic Indian-red clay, usually having a greasy feel. These areas really represent patches of Upshur soil too small to map. Quite commonly the surface material is grayish and the yellow subsoil grades into reddish-yellow to Indian-red clay or the yellow is mottled with red. Such areas represent either the Upshur silt loam or an intermediate type between the Upshur and Dekalb. Some patches of typical Dekalb silt loam or silty clay loam are included in this type. The brownish-yellow subsoil first mentioned is characteristic of by far the greater part of the type.

The depth of the subsoil varies greatly with the position of the areas. On the steeper slopes erosion has prevented the accumulation of much soil material over the rock, the strata in places being exposed or at least very close to the surface. Usually the depth to the bed rock is 20 inches or more. On the other hand, it may not be encountered within less than several feet of the surface.

Throughout the soil mass and on the surface occur more or less decomposed fragments of shale and sandstone, though rarely in sufficient quantity to interfere with cultivation. Their presence is a general characteristic of the type.

The Meigs clay loam has the largest extent of any of the soil types. It occupies all of the uplands of Doddridge and the western part of Harrison county, covering the hill and ridge tops and their slopes.

The Meigs clay loam area is steep and broken, the surface being rougher than any other soil type except rough stony land. The tops of the ridges are generally narrow and irregular and the slopes as a rule descend steeply to narrow, V-shaped stream valleys. A marked feature of the hillsides is the presence of narrow benches or terraces, resulting from the occurrence of massive sandstone beds that have resisted weathering and prevented the formation of uniform slopes. On these benches the soil is deeper and more productive than elsewhere. For the most part the slopes are so steep as to make cultivation very difficult.

The surface drainage is rapid, water falling upon the soil being carried off almost immediately, and where the slopes are not protected by a covering of sod or vegetation the soil material is rapidly carried away, forming erosion gullies. Because of this excessive drainage the type is droughty, crops suffering for moisture in ordinary dry spells, except in more favored locations. The small streams soon dry up, and if the drought is prolonged even the larger streams cease to flow.

The Meigs clay loam is of residual origin, derived from the rock beds of the Dunkard of Permo-Carbonifereous age. This formation consists of a series of interbedded shales, sandstones, some thin limestone or shaly limestone, and coal seams. The gray shales and sandstones and the beds of red shales give rise to most of the soil material of this type.

Although in many places too steep for cultivation, much of the type has been cleared for pasture, the soil being fairly good for grasses. Bluegrass does well, although it is rather short lived, except upon phases of the soil particularly adapted to its growth. North and east slopes make the best pasture land, the southern and western slopes drying out more quickly. Care must be exercised in changing the land from its natural forested condition to pasture, or the soil may be washed away. When newly cleared the soil is full of roots and these ordinarily hold it sufficiently for a few years or until the grasses form a protective sod. Corn is the first crop grown and this is planted until the yields decrease, when small grains, with which the grass is seeded, are sown. The bluegrass holds for a time and then the native wild grasses and broom sedge gradually take the land.

To reestablish the bluegrass the land has to be broken, cultivated and reseeded. The life of the pasture can be prolonged by giving it attention and the growth can be revived by applications of lime, phosphatic fertilizers, and barnyard manure. Timothy and clover are sown and cut for hay, making fine yields. The fields are then pastured, the bluegrass, sown with timothy and clover, finally predominating. On new land corn does fairly well, producing 20 to 50 bushels to the acre. On the benches and on lower slopes the better yields are obtained.

Parts of the type will produce fruits, apples and peaches doing well on the upper slopes in the covelike areas exposed to the north and east, where the soil is more loamy and better moisture conditions prevail. The forest growth is of hardwoods, oak, chestnut, maple, hickory and poplar. The poplar is found more abundantly on the north and east exposures and gives to these locations the name of "poplar land," while the south and west slopes are spoken of as "white oak land."

The Meigs clay loam has the lowest value of the upland soil types, the prices ranging from $10 to $30 an acre, the seller usually reserving the oil and gas rights.

Upshur Clay.

The Upshur clay occurs only in small areas, and the surface soil is variable, being influenced by differences in position. When it occurs on hilltops and the upper parts of slopes it consists of 4 to 6 inches of dark reddish brown or Indian-red clay loam to clay, underlain by dark Indian-red, stiff, rather tenacious clay. Where erosion is not active the subsoil extends to a depth of more than 3 feet, but in places the underlying rock beds may be encountered at 2 feet, and rotten shale fragments of greenish-gray color are often found in the lower subsoil, giving the mass a mottled appearance. On the lower slopes affected by "slips" from soils above, the surface may have a shallow covering of light-brown to grayish silt loam, which when united by cultivation with the red subsoil material gives a reddish color to the surface. Occasionally some sandstone fragments are found on the surface, but these have come from rock formations lying higher up the slopes.

The Upshur clay is found mostly on slopes, which are generally steep, where it occurs as bands, sometimes near the top and again nearer the bottom. It is commonly found in saddles or gaps of dividing ridges extending around the amphitheaterlike heads of branches, its position always being determined by the occurrence of red-shale strata, from which it has been derived through weathering.

The areas are small and scattered, the greater number being found in Doddridge county, though some occur in the western part of Harrison. In both counties it is limited to outcropping of the Dunkard formation.

Though the surface drainage is free, the subsoil is always moist. There is considerable seepage in this rock formation, and moist, springy spots are common on slopes. The moisture conditions make the type cold and late. Its heavy, plastic and tenacious nature cause difficulty in cultivation. When worked too wet it puddles and becomes very hard and cloddy when dry. The surface bakes and cracks.

This soil should never be plowed except under the best of moisture conditions. Late fall plowing, turning the soil up so as to get full effects of freezing and thawing during the winter aids greatly in getting good tilth. The soil should have more organic matter, and any roughage can be plowed under to advantage. This soil is all cleared, but its value for pasture is so high that it is mostly devoted to grazing or used in the production of hay. Bluegrass seeds naturally upon it and is permanent. It gives good yields of farm crops where managed properly. Wheat does well and fair yields of corn are secured, though in places the soil is rather heavy for the latter crop.

Fruits do not seem to thrive upon the Upshur clay, and it should not be used for their culture. Since it is so well adapted to grasses it is best to continue with them, and every effort should be put forth to maintain the pastures at their highest efficiency.

Upshur Silt Loam.

The surface soil of the Upshur silt loam, which is from 10 to 20 inches in depth, consists of a friable silt loam of light or yellowish brown color, with a reddish tinge in the upper portion, changing with depth to reddish yellow or frequently to a dull red. The subsoil is a reddish-yellow to dark-red heavy silt loam to silty clay loam, grading usually into an

Indian-red clay of the same character as the subsoil of the Upshur clay.

The Upshur silt loam is of small extent, being limited to the extreme western part of Doddridge county. It is found on flat, shelflike positions on slopes and on rolling ridge tops.

The Upshur silt loam is derived from the sandstones and shales of the Dunkard formation. Strata of red shale have given the red subsoil and the reddish tinge seen in the surface material.

The type has good surface drainage and is easily worked. It is a strong, productive soil and good farms are the rule on the type. It supports a fine growth of grass and gives good yields of the general farm crops. Its value is high as compared with that of the surrounding soils.

Results of mechanical analyses of samples of the soil and subsoil are given in the following table:

Mechanical Analyses of Upshur Silt Loam.

Number	Description	Fine grave	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
25500....	Soil	0.2	0.9	0.6	1.6	2.5	76.9	17.3
25501....	Subsoil	.0	.2	.3	1.2	2.8	53.2	42.2

Dekalb Silty Clay Loam.

The surface soil of the Dekalb silty clay loam, to a depth of 4 to 8 inches, consists of a light to yellowish-brown silty clay loam or heavy silt loam, containing enough sand particles to make it friable and rather mellow for a soil of its class. When dry the surface becomes grayish and has a soft, ashlike feel. The subsoil is a yellow, heavy silty clay loam to silty clay, generally becoming a little more clayey and more compact with depth. It is usually friable, but in places is somewhat plastic. Grayish to brownish mottlings representing rotten fragments of shale are often noticeable. In places the lower subsoil sometimes becomes slightly tinged with red. Shale and sandstone fragments occur frequently on the surface, the latter as small blocks of thin-bedded rock. On the gentler slopes they are absent, while on steep slopes they are numerous both on the surface and in the soil mass, with the underlying rock beds very near the surface. On these steeper slopes the soil is a little more sandy and lighter textured than elsewhere.

The Dekalb silty clay loam occurs in the eastern part of Harrison county, where it is associated with the Westmoreland silty clay loam. It is found on the slopes below the latter type, following that type rather closely and extending up the valleys. Along the Chestnut Ridge anticline, where the Conemaugh formation outcrops, it covers all except the highest hilltops. These slopes are in the main gentle, but are sometimes very steep, breaking off suddenly from narrow, flat to gently sloping benches on the hillsides. The hilltops are smooth and generally rounded, though in places the ridges have narrow, irregular crests. The topography favors ready surface drainage.

The Dekalb silty clay loam is of residual origin, being derived from the rock beds of that part of the Conemaugh formation extending from the Clarksburg limestone bed to the bottom of the formation as exposed in the county. There are three strata approximately 100 feet in thickness. The rocks consist of a variety of shales and sandstones, with some unimportant beds of limestone and seams of coal. The shales and sandstones have given rise to the larger part of this soil type. The shale beds have weathered more or less completely, the fragments being generally rotten. The stones found in the soil mass are generally of the more resistant sandstones.

The greater part of the Dekalb silty clay loam is cleared and largely in grass for hay and pasturage, particularly the latter. The soil supports a bluegrass sod, but is not naturally so good a soil for grasses as the limestone type—the Westmoreland silty clay loam. The pastures do not last so well, nor is the growth of grass as good on the Dekalb areas. The wild grasses do better on it, but do not make as good pasturage.

Corn gives fair yields on areas of gentler slope, and so do the small grains. Fruits, though grown only for home use and under favorable conditions, do fairly well. With proper attention orchards, especially of apples, would give excellent yields, particularly on those areas having exposures to the north and east.

The greater part of this type should be devoted to pasturage and the steeper and more stony slopes to forestry. The forest growth is composed of hardwoods, consisting largely of oak and chestnut, with maple, poplar, hickory, beech and some other trees.

The results of mechanical analyses of samples of the soil and subsoil of the Dekalb silty clay loam are given in the following table:

Mechanical Analyses of Dekalb Silty Clay Loam.

Number	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
25339....	Soil	0.8	2.3	1.8	6.6	5.0	69.0	14.4
25340....	Subsoil	.4	1.4	1.4	3.6	4.4	56.7	32.2

Dekalb Silt Loam.

The surface soil of the Dekalb silt loam, to an average depth of 8 inches, consists of a light, friable, brown or grayish-brown silt loam, with a soft, smooth texture. The subsoil is a pale-yellow silt loam, which at about 24 inches usually becomes considerably heavier, grading into a silty clay loam. Where the underlying rock beds are close to the surface the deep subsoil may become a little lighter in texture than typical. The type as a rule is free from stone fragments though scattered blocks of sandy shale or shaly sandstones are found occasionally, and where the soil material is shallow may be met in the subsoil.

The Dekalb silt loam is not an extensive type in the Clarksburg area. It is found in comparatively small bodies in both counties, the largest occurring in Doddridge county along the Ritchie county line and east of Bridgeport in Harrison county. The other areas are small and scattered.

This type is generally found in the uplands on shelf or bench-like situations that occur at an elevation of 1,100 feet or more above sea level. The areas are flat, gently rolling, or sometimes sloping. The type owes its origin and characteristic topography to massive horizontal sandstone beds, which are very resistant to weathering processes. The soil material is derived from these fine-grained, massive sandstones and fine-grained sandy shales, the weathering having been as a rule so complete that little fragmental rock occurs in the soil. The underlying rock beds are reached at a depth of 5 or 6 feet. The type is not derived exclusively from any one formation of the upper Carboniferous, but indiscriminately from the Dunkard, Monongahela and Conemaugh, wherever massive sandstone beds occur in those formations.

These sandstone beds have produced a soil considered rather thin and not held in high esteem, except that its friable character makes it easy to cultivate. This soil is readily "run down" by cropping, but it can be brought to a fair state of productiveness by good management.

As a whole, the type is lacking in organic matter and supplying this in the form of green manuring crops and barnyard manure will greatly benefit it. All the cultivated crops of the area are grown. Corn, potatoes, wheat and oats do fairly well. It does not seem to be adapted to bluegrass or other pasture grasses. Moisture conditions have much to do with this, the drainage being too free. Apples will succeed upon it, but the trees need artificial fertilization. Good orchard sites, permitting the use of spraying machinery, are frequently found.

Its original tree growth was largely chestnut and white oak, with some other deciduous species, and from the predominance of chestnut it has been locally known as "chestnut land."

Westmoreland Silty Clay Loam.

The Westmoreland silty clay loam, known in Harrison county as the "limestone land," is derived from interbedded limestones and and shales. These two rock formations give rise to distinct soil materials, which, owing to the sloping topography, have become so intermingled as to respesent a single soil type.

As a rule the type consists of 4 to 10 inches of a grayish to light-brown, mellow silty clay loam, overlying yellow silty clay loam, which quickly grades into yellow silty clay, generally sticky and plastic in the lower portions. Where overlying limestone beds the soil material is a grayish to yellowish heavy clay loam to clay, underlain by a stiff, plastic clay, usually yellow or yellow mottled with white. The subsoil material immediately overlying the limestone is frequently of an olive green color and markedly plastic.

The limestone outcrops occur as narrow strips a few feet in width along the hill slopes. They are usually marked by a slight break in the slopes or "bench" and by loose boulders of the rock on the surface. Such areas of heavy soil usually represent patches of Brooke clay loam too small to map.

The subsoil generally extends to a depth of several feet, except where limestone ledges approach the surface or outcrop. For the most part weathering has been complete, as indicated by the general absence of stone fragments on the surface and in the soil.

The Westmoreland silty clay loam is consigned to Harrison county, in which it is the most important soil type. It is found in all parts of the county, except the western and northwestern portions. The areas are irregular and broken by other types, the tops of the hills often being capped by Meigs clay loam, and the lower slopes by the Dekalb silty clay loam, while this type lies between, following the contours of the hills and ridges. It is the smoothest of the hilly lands of the area surveyed, the slopes being gentle and the hilltops rounded. Some of the slopes are broken by series of slight benches, where limestone ledges lie just beneath the surface or are exposed. Over the greater part of this type the slopes are such as to permit of cultivation, though in places they are so steep that farming is not advisable.

The topography of the Westmoreland silty clay loam gives ready surface drainage and in some places the land is gullied, though the strong sod covering tends to hold erosion in check. The type is all well drained and, as is the case with limestone soils in general, is droughty. Where bodies of this soil have been tunneled in mining coal they soon dry out, and crops or grass suffer for lack of moisture.

The Westmoreland silty clay loam is derived from the rock beds of the lower part of the Monongahela and the upper part of the Conemaugh formations. These are composed of a number of limestone strata, with interbedded calcareous shales and very little sandstone. The weathering of these rocks has been quite complete, with the exception of occasional limestone boulders and outcropping limestone ledges, giving a soil formation of some depth.

Because of its calcareous nature, the Westmoreland silty clay loam is especially adapted to bluegrass and is devoted almost entirely to grazing, being too valuable for this purpose to be used for cultivated crops. The grass thrives on this soil, and the sod holds for a long period of years, though the pasturage is said to be not as good now as formerly. A dressing of phosphate fertilizers would do much to help the pastures, as would applications of manure. Corn and hay grasses (timothy and clover) do very well, but they are not grown extensively.

Owners of this land are all engaged more or less in cattle grazing. Some of the stock is raised on the farm, but a large part is brought in from other sections to be grazed and fattened here.

Practically all the Westmoreland silty clay loam is cleared. The original forest consisted of hardwood species. The locust thrives on this soil and is seen in pastures and along fence rows. The growing of locust posts would undoubtedly prove profitable on the steeper slopes.

Farmers owning this land are generally prosperous. The farms are usually large. The Westmoreland silty clay loam is the highest priced farming land in the area aside from the added value of the important coal seams which occur beneath it. The price of surface rights for this type ranges from $50 to $100 an acre.

The results of mechanical analyses of samples of the soil and subsoil of the Westmoreland silty clay loam are shown in the following table:

Mechanical Analyses of Westmoreland Silty Clay Loam.

Number	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
25349....	Soil	1.1	3.1	1.6	4.1	7.1	60.9	22.1
25350....	Subsoil	1.4	4.2	2.9	5.1	4.4	53.2	29.1

Elk Silt Loam.

The surface soil of the Elk silt loam consists of about 8 inches of light-brown to yellowish-brown, light, mellow to rather compact silt loam. This is underlain by pale yellow silt loam, which becomes somewhat heavier and a brighter yellow with depth. Below 24 inches the subsoil is often slightly sandy, the sand particles giving a gritty feel. The subsoil is usually compact in the lower portion, but when rubbed between the fingers it readily crumbles. When wet it is quite sticky.

This type is fairly uniform in texture, though slight variations occur. In places the surface soil is a little more sandy than the average, especially on the break of slopes where beds of fine yellow sand lie below. Occasionally shale ledges and broken shale are encountered within 2 feet of the surface, the former being projecting points of underlying formations.

The Elk silt loam occupies a considerable area. It covers a greater extent of territory in Harrison county, where it is found in the West Fork river valley and along its tributary streams. It occurs as a terrace, the top of which is 1,000 to 1,050 feet above sea level and from 20 to about 150 feet above the stream levels. In places the top is flat to gently rolling, breaking into slopes toward the streams, the drop sometimes being very abrupt. Originally these terraces were uniformly smooth and level, but erosion has cut many deep ravines. The streams along which it occurs have meandering courses, the type usually occupying the horseshoe bends, and extending from the stream generally to the upland slopes. It holds the position of a well-defined stream terrace.

The Elk silt loam is a sedimentary soil and believed to be of lacustrine origin. When the Monongahela in its lower course was blocked by ice during the glacial period its waters backed up and formed a lake covering the valley. The fine sediments forming this soil were dropped at that time filling the valley to the highest point now seen in the development of this soil. When the river resumed its flow it began to cut a channel into its sediment-filled valley in a zigzag course, forming what are now the horseshoe bends. The river has now cut down to a rocky floor and is still widening its channel, although the process has not continued long enough to form extensive first bottoms.

Some of the material entering into the formation of the type is doubtless residual in origin, being derived from the underlying sandy shale and massive sandstone beds. Such residual material is represented by the sandy layers in the lower subsoil already mentioned as developed in some places. A large proportion of the material entering into the composition of the type has been washed from the productive Wesmoreland silty clay loam. In places near the foot of the upland slopes colluvial material has accumulated.

Lying as it does upon terraces along streams, the Elk silt loam is a well-drained soil. It is mellow, friable and easily cultivated. Its favorable surface and proximity to streams made it one of the first soils to be cleared and it has been under cultivation for a long time. It is devoted to the general farming crops of the region, of which corn is the most important. Under the present system of management the yields range from fair to good. The type could be greatly improved by the more extensive production of leguminous crops and by the incorporation of organic matter. Much of it is devoted to grass for hay and pasture. Bluegrass and timothy give fairly good results and small grains, especially wheat, do well.

This is one of the best soil types of the area for trucking, both in texture and in location. A ready local market awaits its development for the production of vegetables. Irish potatoes, sweet corn, tomatoes, beets and cabbage should do especially well. Small fruits such as raspberries, blackberries and strawberries would also prove profitable. Most of the type is suited to apple orcharding, as the land lies high enough above the stream to have good air and water drainage. It has the best of facilities for marketing such products, as a railroad and electric line, the latter equipped for carrying freight and express, run through the West Fork Valley.

The Elk silt loam is generally deficient in organic matter. The sod could be much improved by plowing under some green manuring crop, such as rye, clover, cowpeas or vetch, before reseeding. A profitable system of management would be to carry on dairying, trucking and fruit growing, using the manure from the dairy to enrich the soil.

Chestnut formed the larger part of the original forest on this soil and the land is commonly spoken of as "chestnut land." Farms of this type of soil bring high prices.

Tyler Silt Loam.

The Tyler silt loam consists of a grayish-brown to yellowish-gray friable silt loam, with a depth of about 8 inches, underlain by pale-yellow to yellow, compact, sticky clay loam, more or less mottled with gray, drab and brown. It becomes heavier and more dense in structure with depth, being frequently in the lower portion a silty clay.

Its extent is small and unimportant, small scattered areas occurring over the two counties as second bottoms along some of the larger creeks. It is alluvial in origin and was deposited when the water of streams reached higher levels, or rather when their flow was impeded by the backwater of the larger streams when blocked by glacial ice. The sediments forming the type are the wash from the contiguous uplands.

The Tyler silt loam wherever found in the State is a compact soil, generally rather poorly drained, and therefore a cold, late soil. When thoroughly drained and properly handled the surface is friable and mellow. Its greatest need is drainage and the incorporation of organic matter. With such improvement it can be made to yield fair crops. An application of 1 ton of burnt lime per acre or its equivalent in other forms of lime would benefit the soil. In the present survey it covers so small an area that it is unimportant.

Mechanical analyses of typical samples ot the soil and subsoil give the following results:

Mechanical Analyses of Tyler Silt Loam.

Number	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
25345....	Soil	0.1	1.6	1.7	3.5	3.7	68.1	20.9
25346....	Subsoil	.4	2.5	2.3	4.1	5.3	45.6	39.7

Huntington Silt Loam.

The Huntington silt loam consists of 10 to 12 inches of light-brown to brown, mellow silt loam underlain by yellow or yellowish-brown silt loam, usually becoming heavier and more compact with depth. Occasionally some gravelly fragments of shale and sandstone occur either as a definite substratum or scattered indiscriminately through the soil mass. This condition is found along small streams which at times carry greatly increased volumes of water.

The Huntington silt loam occurs in this area only in Harrison county, where it is found in all parts, though in small areas, as narrow strips of first bottom land along the streams. It is associated with the upland soils derived from the Monongahela and Conemaugh formations, and represents the wash from the bordering slopes. It is an alluvial soil of recent formation, and is practically always present on the creeks and branches, though as a rule in very narrow strips along the larger streams. The areas are not continuous, being found only in narrow strips on the inner sides of curves or bends. The larger streams are still cutting their channels and not building flood plains.

While the extent of this soil is small, with its general distribution and its high productive power it is an important soil. Nearly every farm depends upon it for the production of the cultivated crops. Corn does especially well and good yields are obtained without fertilizers, the productiveness being maintained by the addition of sediments at every overflow. Grasses do well and large crops of hay may be expected. The pasturage is excellent.

Originally the Huntington silt loam supported a heavy forest growth of beech, maple, hickory, poplar and many other deciduous trees.

Like the Moshannon silt loam, the type is held in high esteem and is an important factor in determining farm values.

Moshannon Silt Loam.

The surface soil of the Moshannon silt loam to a depth of 8 to 12 inches consists of a mellow silt loam, varying in color from dark or chocolate-brown to reddish-brown. The subsoil, like the soil, is a silt loam, though slightly heavier, of a more compact structure, and generally of a stronger red than the surface soil. In places the subsoil is yellowish or brownish yellow and very similar to the subsoil of the Huntington silt loam, and areas occur where separation is difficult. Frequently a gravelly substratum is encountered at a depth of 24 inches or below. The gravel consists of pieces of shale and sandstone, merely rounded enough to be subangular, fully rounded, waterworn gravel not being of common occurrence. Similar fragments are sometimes found on the surface, especially close to the streams or at their confluence. Along the banks of the streams the soil material frequently becomes sandy and, again, in places where the drainage is poor, it appears more clayey, and the subsoil is drab colored or mottled drab, yellow and brown.

Occurrences of the Moshannon silt loam are limited to Doddridge county and the western part of Harrison, where the type is associated with the soils derived from the Dunkard formations. It represents wash from these types transported by the streams and laid down in small strips as first bottom land. These bottoms are always narrow and may be wanting along the larger streams, except on the inner side of bends. On the smaller streams and branches the type is almost always in evidence.

Though occurring in small areas, the type is an important one, as it is widely distributed. It forms a part of practically every farm and is the soil most depended upon for the corn crop and for hay and grain as well. Corn does well on the overflowed alluvial lands and yields running from 50 to 100 bushels to the acre are common. One or two tons of timothy hay can be cut to the acre and crops of small grains grow luxuriantly and give good yields. The land is devoted mainly to corn and grass. It furnishes excellent pasturage throughout the grazing season.

Being level, free from stones, easily worked, and highly productive, it is a desirable soil and held at much higher prices than the surrounding hill lands. While its actual market value can not be stated, the extent to which it occurs on farms largely determines their selling price.

Holston Silt Loam.

The Holston silt loam consists of 8 inches of friable, light-brown silt loam, underlain by pale-yellow silt loam, as a rule somewhat heavier than the surface, but often in lower depths, where it overlies sandstone and shale, somewhat sandy.

The Holston silt loam is found mainly along Middle Island creek and its tributaries. A few small areas occur along other streams which do not traverse the Westmoreland silty clay loam or other calcareous soils of the area. It is a terrace formation, occurring in the horseshoe bends from 20 to 100 feet or more above the streams. The material represents sediments deposited by the streams when at a higher level than at present. The sediments came originally from the sandstones and shales, giving the residual types Meigs clay loam and Dekalb silt loam. Thus, while this type corresponds in process of formation to the Elk silt loam, it differs in the materials from which derived the latter being formed largely from the wash of calcareous soils.

The Holston silt loam is noncalcareous and of lower productiveness than the Elk silt loam. It is low in organic matter and not a strong soil, being known locally as "light land." It is an easy soil to cultivate, and by supplying humus it could be improved and made to produce much better yields of the general farm crops than it does at present.

Rough Stony Land.

Rough stony land is represented by steep and stony areas unfit for agriculture. The type occurs most frequently on steep hillsides, extending frequently from the top of the ridge to the stream below. It is caused by massive outcrops of sandstones that stand as sheer cliffs, below which the talus of boulders renders the land rough and stony. Frequently where the talus is absent the underlying shales are so close to the surface as to make cultivation difficult. The soil material is similar to that of the adjacent slopes and the term denotes a condition rather than difference of soil textures. Excepting the areas of outcropping rock the land is covered by the prevailing tree growths and underbrush. Chestnut and oak are the most prominent species.

Areas of rough stony land are not common and do not cover much territory. They are found here and there along streams, and are most numerous in Doddridge county, along the Ritchie and Tyler county lines, and up Middle Island creek and its tributaries, where the massive sandstone appears above the drainage levels. A few scattered areas are found in other parts of the survey. The rough stony land should be left in forest.

SUMMARY

The Clarksburg area is situated in the north-central part of the State. It comprises Harrison and Doddridge counties, and has an area of 781 square miles, or 499,840 acres. It consists of an original high plateau cut by stream valleys eroded from 500 to 800 feet below the general upland level.

The altitude of the area ranges from 780 to 1,840 feet. The surface is hilly to broken.

The general drainage of the area is into the Ohio river. Harrison county is drained by the West Fork river and its tributaries. Middle Island creek drains all of Doddridge county except the extreme southwest, which is drained by streams forming the headwaters of the Hughes river. The general flow of the drainage waters is in a northerly direction.

The area was first settled at what is now Clarksburg in 1773 by immigrants from Maryland and Virginia. Settlement was slow until the discovery of minerals and the opening of the district for their development. Within the last 20 years a large influx of foreigners has taken place. The population of the county has doubled within that period, the census of 1910 showing 48,381 inhabitants.

The area has good railroad facilities, being crossed by a trunk line of the Baltimore & Ohio Railroad system. Direct communication with Pittsburgh is had over a line down the valley of the West Fork river.

The climate of the area is suited to general farming. The mean annual temperature is 53° F.; the mean annual rainfall 43.5 inches.

Stock raising is the leading industry of the farm, the land being in most places too hilly for successful cultivation. Grasses and hay are the principal crops. On cultivated areas corn, oats, some wheat and vegetables are the chief products.

Eleven soil types, exclusive of rough stony land, were separated and mapped in the area. These may be divided into two classes according to origin: (1) residual soils and (2) transported or sedimentary soils.

Meigs clay loam is the most extensive type in the area. It covers most of the uplands of Doddridge and of western Harrison counties. Its topography is steep and broken. It is used largely for pasture or remains in forest.

The Upshur clay, derived from beds of red shales, occur in small areas on hillsides. It is a productive soil and ranks next to the limestone soil (Westmoreland silty clay loam) in adaptability to bluegrass.

The Upshur silt loam is of small extent, being limited to areas in the central districts on the extreme western boundary of Doddridge county. It is a strong, productive soil.

The Dekalb silty clay loam is associated with the limestone land of Harrison county, but like the Dekalb silt loam is not a strong soil, not holding grass well. It is characterized by hilly topography and occurs on very steep slopes.

The Westmoreland silty clay loam is the limestone land of Harrison county and is especially prized as grazing land because of its natural adaptation to bluegrass. Stock grazing is most important on the farms of this type.

The valley soils are those of the high terraces and the first bottoms. The Elk silt loam is found on the high terraces in the main stream valleys. It is not a strong grass soil, but can be easily improved and has a wide range in adaptation. It offers opportunities for the development of a trucking industry to supply local markets in the towns and at the mines.

The Tyler silt loam is a second-bottom soil of small extent.

The first-bottom lands comprise two types, the Moshannon silt loam and the Huntington silt loam. The former occurs in the western part of the area and is influenced by the wash from the red shale soils. The Huntington silt loam is a brownish first-bottom soil and is closely associated with the limestone lands of the county. Both these types are very productive and are most important in the agriculture of the county, though the areas are small and scattered.

Rough stony land comprises the precipitous cliffs of massive sandstone on the hillsides, with talus slopes beneath. They have no value except for forestry and grazing.

The average size of farms in Doddridge county is 107.6 acres and in Harrison 116.7 acres. The percentage of farms operated by the owners in Doddridge county is 75.7 and in Harrison 81.5.

Farm labor is scarce, better wages being paid in the oil and gas fields. With the development of these resources and the sale of coal lands considerable revenue accrues to landowners in royalties and rentals, making them generally prosperous. This fact has diverted attention from farming.

Stock raising should be extended. By improving the pastures by reseeding oftener and by using fertilizers the grazing capacity of the land could be greatly increased. The rougher lands should be utilized for sheep raising.

Fruit growing might well be developed and apples in particular would do well on the north and east slopes. The terrace soils are adapted to truck crops, for which there is a strong demand in local markets. The same is true of dairy products and poultry.

The opportunity for systematic forestry appears promising. Much of the rough land is suited to little else. Many of the steep slopes now suffering from erosion might be reforested and the timber grown used for fence posts. This would seem to be the type of forestry offering the most immediate profits.

APPENDIX.

LEVELS ABOVE MEAN TIDE IN THE DODDRIDGE-HARRISON AREA.

Grafton and Parkersburg Branch of the Baltimore & Ohio Railroad.

Distance from Grafton Miles	Station	County	Elevation above Tide Feet
0.0	Grafton	Taylor	999.85
17.2	Bridgeport	Harrison	984.00
22.2	Clarksburg	Harrison	1008.7
23.7	Adamston	Harrison	965.0
25.8	Wilsonburg	Harrison	985.0
26.9	Katy Lick R. R. Junction	Harrison	1013.0
29.5	Wolf Summit	Harrison	1133.0
31.0	Maken	Harrison	1054.0
33.6	Bristol	Harrison	1030.0
35.6	Salem	Harrison	1047.0
36.8	Industrial School	Harrison	1074.0
41.2	Long Run	Doddridge	855.0
43.6	Morgansville	Doddridge	813.0
46.4	Smithburg	Doddridge	797.0
48.0	Rock Run	Doddridge	788.0
49.5	West Union	Doddridge	822.0
52.5	Central	Doddridge	816.0
55.7	Duckworth	Doddridge	950.00
56.7	Greenwood	Doddridge	874.0
103.1	Parkersburg	Wood	642.0

Monongahela River Branch of the Baltimore & Ohio Railroad

Distance from Fairmont Miles	Station	County	Elevation above Tide Feet
0.0	Fairmont	Marion	882.66
13.3	Enterprise	Harrison	909.91
14.3	Viropa	Harrison	906.76
15.5	Riverdale	Harrison	907.66
15.9	Shinnston	Harrison	908.93
19.2	Haywood	Harrison	912.09
20.8	Gypsy	Harrison	912.16
21.5	Maulsby	Harrison	926.46
23.4	Meadowbrook	Harrison	920.50
24.8	Haning	Harrison	935.96
28.1	Glen Falls	Harrison	928.50
30.6	Northview	Harrison	975.06
31.4	W. Va. & Pittsburgh Junction	Harrison	993.46
32.1	Clarksburg	Harrison	1008.72

West Virginia & Pittsburgh Branch of the B. & O. R. R.

Distance from Clarksb'g Miles	Station	County	Elevation above Tide Feet
0.0	Clarksburg	Harrison	1008.72
1.3	West Clarksburg	Harrison	951.36
5.3	Lynch Mine (Station)	Harrison	963.46
7.2	Byron	Harrison	1016.30
12.2	Lost Creek	Harrison	1026.30
121.0	Richwood	Nicholas	2199.80

West Virginia Short Line Branch of the B. & O. R. R.

Distance from N. Martinsville Miles	Station	County	Elevation above tide Feet
0.0	New Martinsville	Wetzel	633.7
33.35	Bridge No. 328, Talkington Creek	Harrison	965.
34.00	Bridge No. 334, Fishing Creek	Harrison	994.
35.87	Tunnel No. 3, West end	Harrison	1078.82
37.00	Bridge No. 364, Mud Lick Run	Harrison	1068.
38.67	Bridge No. 380, Little Ten Mile Creek.	Harrison	1038.
38.85	Bridge No. 382, Little Ten Mile Creek.	Harrison	1034.5
38.89	WALLACE	Harrison	1034
39.10	Bridge No. 384, Little Ten Mile Creek.	Harrison	1030.5
39.29	Bridge No. 386, Little Ten Mile Creek.	Harrison	1027.5
40.34	Bridge No. 397, Little Ten Mile Creek.	Harrison	1009
41.01	Bridge No. 404, Little Ten Mile Creek.	Harrison	1001.5
41.22	BROWN	Harrison	999
41.71	Bridge No. 411, Little Ten Mile Creek.	Harrison	995.5
42.36	Bridge No. 418, Little Ten Mile Creek.	Harrison	984
42.72	Bridge No. 421, Little Ten Mile Creek.	Harrison	979.5
42.98	Bridge No. 424, Little Ten Mile Creek.	Harrison	976
43.85	Bridge No. 432, Little Ten Mile Creek.	Harrison	967.5
44.52	Bridge No. 439, Little Ten Mile Creek.	Harrison	959
44.70	Bridge No. 441, Little Ten Mile Creek.	Harrison	957
44.96	Bridge No. 443, Little Ten Mile Creek	Harrison	953
45.32	Bridge No. 447, Little Ten Mile Creek.	Harrison	948.5
46.38	Bridge No. 458, Little Ten Mile Creek.	Harrison	936
47.83	Bridge No. 472, Little Ten Mile Creek.	Harrison	934
48.09	Bridge No. 475, Little Ten Mile Creek.	Harrison	933
49.13	Bridge No. 485, Little Ten Mile Creek.	Harrison	925
49.27	LUMBERPORT	Harrison	927.83
49.46	Bridge No. 488, Little Ten Mile Creek.	Harrison	927.08
49.68	Bridge No. 491, Little Ten Mile Creek.	Harrison	929
52.49	Bridge No. 518, Lambert Run	Harrison	988.08
54.10	Hepzibah Summit	Harrison	1033.12
57.16	Bridge No. 566, Crooked Run	Harrison	985
58.25	Bridge No. 576, Limestone Run	Harrison	969
58.55	Adamston	Harrison	968
59.21	Bridge No. 586, Elk Creek	Harrison	970
59.6	CLARKSBURG	Harrison	1008.72

For other elevations, determined by the United States Geological Survey, and arranged by quadrangles, the reader is referred to Bulletin II of the West Virginia Geological Survey.

INDEX.

A

Page

Abbreviations, Doddridge records 288-289
Abbreviations, Harrison records 406-407, 426
Acme Carbon Co..........656, 659
Adams, J. J., No. 1.......302, 400
Adams, Wm., No. 1............298
Adamston, Acct. of............25
Adamston section.............117
Adamsville section............107
Adolescence of rivers...........33
Age of rivers..................38
Agriculture 666-671
Albers, Christian, No. 1...........................85, 300, 384
Albright, G. W., Nos. 1 & 3...........................414, 464
Albright, G. W., No. 2.........414
Allegheny Series, Table.........68
Allegheny Series, Thickness...130
Allen, Benton, No. 5......292, 325
Allen, Boyd, No. 1............422
Allen, Israel, No. 1.......292, 323
Allen, M. N., No. 1............292
Allen, W. B., No. 7.......292, 325
Allen, Wm. T., No. 1......410, 448
Allender, C. D., No. 1.........298
Alliance section...............141
Ames limestone...........250-256
Ames shale....................250
Analyses of coal..........633-640
Analyses of Natural gas.......508
Anderson, B. F., No. 2.........420
Andrews 250
Ankrom, David No. 1...........298
Ann Run section...............222
Anns Run, Coal on.............256
Ann Run, Limestone on........250
Anticline, Definition of.........48
Anticlines, Description of:
  Arches Fork..................55
  Beards Run...................59
  Big Moses....................54
  Chestnut Ridge...............58
  Ruraldale 60
  Wolf Summit..................56
Arches Fork anticline..........55
Area by districts:
  Doddridge county.............6
  Harrison county.............11
Arnold creek................36, 45
Arnold creek, coal along.......189
Arnoldsburg sandstone........194
Ash, Angeline, No. 1......422, 530
Ash, J. H., No. 1.........292, 323
Ash, L. E., No. 159............414
Ash, Silas, No. 2.........292, 329
Ash, Thomas, No. 1...........292
Ashcraft, A. J., No. 1.....290, 307
Ashcraft, A. J., core test......290
Ashcraft, Caleb, No. 1.........290

Page

Ashcraft, Chas., No 1.........416
Ashcraft, Curtis, No 1.........418
Ashcraft, Geo., No. 1.....290, 307
Ashcraft, Joseph, No. 1...420, 518
Ashcraft, O. V., No. 2117..416, 492
Ashcraft, Wm., No. 1..........422
Ashley, Coal near.............158
Ashley section................136
Avon, coal near...............164
Axis of folds...................48
Ayers, L. J., No. 1........414, 474

B

Bailey, A. C., Nos. 1 & 8.......................410, 452, 455
Bailey, Calvern, No. 1.........410
Bailey, F. M., No. 1.......414, 475
Bailey, Marshall, No. 1...410, 442
Baker, J. C., No. 1............408
Baker, Sarah, No. 1.......416, 489
Bakerstown coal..............267
Ballouz, A. C., No. 1......290, 309
Baltimore & Ohio R. R.:
  Coal on..................257, 640
  Levels on................696-697
  Monongahela River Branch...2
  Southwest Branch.............2
  W. Va. & Pittsburgh Branch...2
  W. Va. Short Line Branch.....3
Barnard Coal Co..........608, 638
Barnes, Susan, No. 5......410, 454
Barnett run, Limestone on.....238
Bartlett, Addison, No. 1.......422
Bartlett, C. D. No. 1......290, 318
Bartlett, Dora (J. R.), No. 1.........................420, 516
Bartlett, F. J., No. 1......290, 317
Bartlett, Homer, No. 1........412
Bartlett, J. R., No. 1......420, 519
Bartlett, J. R., coal mine..575, 635
Bartlett, L. E., No. 1.....408, 434
Bartlett, S. R., coal mine......206
Bartlett, S. T., No. 1..........292
Bassell Heirs Nos. 1 & 2..424, 543
Bassell, L. M., No. 1......424, 542
Bates-Harbert No. 1......408, 436
Bates, Ucal, No. 1941.....290, 305
Bayard sand..................283
Beacon Carbon Black plant.........................656, 660
Bean, J. W., coal mine........576
Beards Run anticline...........59
Beards Run section...........223
Bee, Rachael (Wycliff), No. 1 ....298, 367
Beech Heirs No. 1.............422
Beede, J. W., Report of.......253
Bender, J. G., No. 1...........422
Benedum Heirs No. 1..........422
Benedum, J. D., coal mine.160, 633
Bennett, E. T., No. 1......408, 429
Bennett, Frank L.............647

Page
Bennett, I. C., No. 1......414, 480
Bennett, Mary A., No. 2.......408
Bennett, Stephen, No. 2.......414
Bennett, T. C., Nos. 1 & 3.408, 434
Benson, Population of..........31
Benson section...............102
Benwood limestone............197
Berea Grit sand...........85, 277
Bice, Beckwith, No. 1.........414
Bice, H. H., No. 1............420
Bice, H. H., core test.........420
Bice, J. L., No. 1.............420
Big Battle section.............74
Big Dunkard sand............274
Big Injun sand...........277, 281
Big Isaac, Acct. of............10
Big Isaac sections.........89, 140
Big Lime 276
Big Moses anticline............54
Bingamon creek............36, 40
Birmingham shale.............248
Bishop, I. C., No. 1............424
Blake, L. D., No. 1........424, 548
Bland, H. J., coal mine........163
Bland, John, No. 1........300, 387
Blue Monday sand............334
Blue Ridge Coal Co...563, 590, 635
Bode, Henry, No. 1.......300, 385
Bode, James H., Nos. 1 & 8..
........................298, 381
Bode, John A., Nos. 1 & 2.298, 381
Bode, Wm. H.............298, 381
Boggess, E. S., No. 1..........290
Boggess, Lee (C. E)., No. 4..
........................418, 501
Boiler tests of coal.......605, 610
Booher, Frank, No. 1..........418
Booher, W. J., No. 1..........290
Booth (Carr) H., No. 1....424, 554
Booths creek...............36, 42
Boothsville section............109
Boughner, D., No. 1.......412, 464
Brady, S. D..579, 580, 581, 582, 591,
592, 593, 594, 598, 599, 600, 601,
602, 603, 604, 610, 611, 614, 615
Bramer, Benj., No. 1..........410
Brannon, P., No. 1........300, 348
Brick Plants..............346-350
Bridgeport, Acct. of............26
Bridgeport clay mine..........236
Bridgeport, Coal at...........257
Bridgeport electric line.........3
Bridgeport Lamp Chimney Co..27
Bridgeport, Pottery at.........27
Bridgeport Saw & P. M. Co.,
No. 1..................422, 535
Bridgeport sections...119, 245, 251
Briggs, I. L...................18
Bristol, Acct. of...............29
Bristol, Coal near.............167
Bristol limestone.............168
British Thermal Unit..........565
Britton, Fielding, No. 1.......296
Broadwater, C. P., No. 1..298, 371
Brohard, J. I., Coal on....256, 640
Brooks, A. B.............653, 654
Brown, B. H., Nos. 12 & 13.
......................412, 464
Brown, B. W., No. 1......422, 528
Brown, J. W., No. 1..........422
Brown, W. B., No. 1588...414, 481
Brown, Acct. of................31

Page
Brown, Coal near.........166, 192
Brown section..................90
Browns creek 36
Browns creek, Quarries along.230
Brush creek coal.............269
Brush Creek limestone.........269
Brushy Fork section..........208
Buffalo sandstone.............268
Building stone............651-653
Burchfield syncline............60
Burnside, Asa 215
Burnside, G. W., No. 1....302, 400
Burnside & Smith No. 1...424, 551
Burnside, Mary J., No. 1..424, 552
Burnside, W. S. No. 1.....414, 481
Burnside, W. S., No. 1........414
Burton sandstone.............148
Bush, C. L.....................16
Byron, Acct. of................28
Byron Coal Co........564, 612, 639
Byron, Quarries at........230-231
Byron section................122

C

Cabot, Godfrey L., Paper by.
.... 657-660
Cain, Ed., No. 1...............296
Cain, Silas, No. 1.........294, 343
Cain, Vincent, No. 1......296, 351
Caldwell, Chas., coal mine.....162
Camden Heirs No. 1......290, 313
Camden, J. N...................2
Campbell, Jos. M., No. 1.......416
Canton, Coal near.............159
Canton section 75
Carbon Black industry.....656-660
Carbon Black, Manufacture of.
.... 657-660
Carder, Isaac, No. 2...........416
Carboniferous rocks, Table of.
.... 68-69
Carder, J. B., No. 1............302
Carr, J. M., No. 1.............422
Carr, M. J., No. 1.........294, 339
Carter, Harrison, No. 1........422
Carter-Harris No. 1.......298, 364
Cascara section...............137
Cassville Plant shale..........176
Castle Brook Carbon Co...656, 659
Catskill series, Thickness.....130
Cavalier, S. A., No. 4......408, 432
Centerpoint oil pool...........285
Centerpoint, Acct. of............9
Centerpoint, Coal near.....158-159
Centerpoint section............72
Central District, Area of....... 6
Central District, Minable coal.623
Central District, Prospective oil.
.... 369
Central District sections 80-92
Central District well records
.... 363-370
Central Fairmont C. Co......
..................563, 607, 638
Central Station, Acct. of........8
Central Sta., Meteorological
data 663-664
Central Station section........139
Chalfant, Nettie (Martha),
No. 1..................420, 520
Chalfant, Wm., No. 1878..416, 492

Page
Chambers, W. A..............516
Chapman, L. G., No. 1....298, 381
Chemung series, Thickness of.130
Chestnut Ridge anticline.......58
Cheuvront, Joseph, No. 1..296, 356
Chisler, John, No. 1.......296, 366
Clark and Schuchert...........122
Clark, Geo. R.................15
Clark, Charlotte, No. 3....302, 399
Clark, Marcellus, No. 2...302, 400
Clark District, Area of.........11
Clark District, Minable coal...629
Clark District, Prospective oil.530
Clark District sections ...114-118
Clark District well records... 528-531
Clarksburg:
  Account of..................13
  Glass industries..............15
  Limestone at...............226
  Miscellaneous industries......17
  Population 15
Clarksburg Casket Co..........19
Clarksburg coal, Little........231
Clarksburg Foundry and Casting Co......................19
Clarksburg fire clay shale.236, 644
Clarksburg Gas Coal Co...... ....564, 571, 615, 633, 640
Clarksburg Glass Co...........15
Clarksburg High Grade Shale Brick Co...................647
Clarksburg limestone 237-240
Clarksburg Opalescent Glass Works 17
Clarksburg red shale..........240
Clarksburg section 112, 182
Clays, Transported........644-646
Clarksburg Zinc Co............18
Clays and clay industry...643-646
Clay District, Area of.........11
Clay District, Minable coal....627
Clay District, Prospective oil.522
Clay District, Sections ...107-110
Clay District well records.505-522
Cleiland, James................15
Climate 661-666
Coal Analyses, Table of...633-640
Coal, Chapter on..........560-642
Coal, Minable 565
Coal, Minable, by districts.621-631
Coal mines, Page reference to.641
Coal, Summary of............620
Coal production, Statistics of:
  Harrison county.........561-564
  Order of counties...........561
Coals, Diagram of............566
Coals of Allegheny series.619-620
Coals of Conemaugh series.. 617-618
Coals of Dunkard series.......565
Coals of Monongahela series. 568-617
Coal District, Area of..........11
Coal District, Minable coal....628
Coal District, Prospective oil..527
Coal District sections.....110-114
Coal District, well records.. 522-528
Coffindaffer, Abram, Nos. 2 & 3...................414, 475
Coffindaffer, Emily F., No. 1...416

Page
Coffman, E. L., No. 1.....418, 500
Coffman, E. L., No. 2362.......418
Coffman, Felix, No. 1.....408, 434
Coffman, Geo., No. 1..........416
Coffman, James, No. 1....418, 493
Coffman, Luther, No. 1.........416
Coffman, Theodore, No. 1......418
Coke production...........562-564
Coking tests of coal......606, 610
Coldwater sections.........86, 139
Cole, D. M., coal mine........212
Coleman, Thos., Jr.............17
Collins, Alfred, coal mine.190, 653
Conemaugh Series, Discussion of 220-269
Conemaugh Series, Thickness of 130
Conley, Arthur, No. 1.....424, 557
Conley, Edward, No. 1....294, 424
Connellsville sandstone ...229-231
Consolidation Coal Co. well....422
Consolidation Coal Co., No. 1..420
Consolidation Coal Co.:
  Mine No. 21........562, 590, 636
  Mine No. 23................562
  Mine No. 25........562, 603, 638
  Mine No. 27........562, 594, 636
  Mine No. 29........562, 603, 638
  Mine No. 31............562, 639
  Mine No. 32........562, 585, 635
  Mine No. 33........562, 594, 636
  Mine No. 35........562, 599, 637
  Mine No. 36............583, 634
  Mine No. 39........562, 611, 639
  Mine No. 40........562, 580, 634
  Mine No. 42........562, 582, 634
  Mine No. 44........562, 614, 639
  Mine No. 46........562, 610, 639
  Mine No. 48........562, 595, 636
  Mine No. 49........562, 579, 633
  Mine No. 50....562, 599, 600, 637
  Mine No. 51........562, 581, 634
  Mine No. 52........562, 604, 638
  Mine No. 54........562, 583, 634
  Mine No. 55........562, 592, 636
  Mine No. 58........563, 603, 638
  Mine No. 60........563, 612, 639
  Mine No. 61........585, 634-635
  Mine No. 62....563, 595, 636-637
  Mine No. 64........563, 614, 639
  Mine No. 65........563, 580, 634
  Mine No. 66........563, 581, 634
  Glen Falls Mine....562, 594, 636
  Maulsby Mine..........591, 636
  O'Neil Mine No. 2......599, 637
  Reynoldsville Mine......597, 637
Cook C. & C. Co......563, 592, 636
Cook & Hart Coal Co.........564
Cookman, Adam, No. 1........424
Coon, Robt. W., No. 1...... ....112, 422, 527
Cooper, Frank, No. 1......296, 367
Copeland Heirs No. 1.....412, 472
Copenhaver, Acena, No. 1.416, 486
Copenhaver, J. E., No. 1..416, 485
Coplin Heirs No. 1...........120
Cornell and Lang, Coal on.258, 640
Corona C. & C. Co....563, 596, 637
Corpening, Alice, No. 1....420, 510
Corpening, Geo. E., No. 1......422
Cost, John, No. 1.........117, 422
Costilow, Joseph, No. 1.......294

Page
Costilow, W. A., No. 1........294
Coulehan, John, No. 1.....296, 354
County Farm No. 1...........298
Cove creek 36
Cove District, Area of..........6
Cove District, Minable coal....623
Cove District, Prospective oil development 385
Cove District section........83-85
Cove District, well records.. 381-386
Cow Run sand, 1st...........273
Cow Run sand, 2nd...........274
Cox, D. E., No. 1.............302
Cox. Jacob, No. 1.........300, 394
Cox, J. M., No. 1..........300, 393
Cox & Reed No. 1.............420
Crabtree, J. D., No. 1......77, 294
Craigmoor, Limestone near....263
Creston Red Shale............155
Crinoidal coal.................256
Crocker-Hall No. 1........416, 476
Cronmeyer, E. L..............18
Crook, B. M., core test........300
Crooked Run, Coal at.........233
Cross, S. S., No. 1....412, 452, 469
Cumberledge, George, Nos. 1 & 2....................292, 320
Cumbridge, Henry, No. (1)....292
Cumpston, J. C., No. 1....300, 394
Cunningham, Dan'l F., No. 1. ....416, 490
Cunningham, J. B., No. 1.... ....105, 418, 493, 508
Cunningham, Jack, No. 1933.. ....298, 368
Curry, Frank C., No. 1....416, 475

D

Dakon, J. G., No. 3........412, 465
Daniel Coal Co.......564, 613, 639
Davidson, Edgar, No. 1........302
Davis, Albert A., No. 1....294, 347
Dav's, C. G., No. 1........294, 340
Davis, Felix, No. 1............294
Davis, F. M., No. 1...........414
Davis, Hick, No. 1.........300, 396
Davis, H. S., No. 1....416, 484, 487
Davis, Isaac, No. 1...........290
Davis, Levi, No. 1............424
Davis, Lloyd, No. 1.......296, 353
Davis, L. D., No. 1............302
Davis, L. T., No. 1.......296, 355
Davis, Lucius, No. 1..........422
Davis, O. G., No. 1............302
Davis, R. G., No. 3.......302, 400
Davis He'rs No. 1.............420
Davis, S. O., No. 1............424
Davisson, A. H.......126, 424, 557
Davisson, Claude, No. 1..... ....123, 422, 539
Davisson, C. W., No. 1....290, 314
Davisson, Edgar, No. 1....302, 402
Davisson, Josiah, coal mine...159
Davisson, Josiah, No. 1..290, 306
Davisson, L. B., No. 1....424, 547
Davisson, M. V., No. 1.....412, 458
Davisson, M., Nos. 6 & 11.... ....294, 348, 412, 459
Davisson, M. K., No. 1840.408, 441
Davisson, Reason, No. 1.......424
Davisson, R. B., No. 1........294
Davisson, S. J., No. 1.....424, 547
Dav'sson Run, Coal on........258
Dekalb silt loam..............652
Dekalb silty clay loam........680
Dekalb silty clay loam, Analysis of........................682
Denham, M. E. & E. G., No. 1..418
Dennison, E. L., No. 1.........408
Dennison, E. L., No. 1.........410
Dennison, J. W., No. 13.......412
Despard, B. M..................91
Devonian rocks, Table of.......69
Devonian rocks, Thickness of..130
Dewhurst, J. B., Nos. 1 & 18. ....292, 319
Deweytown, Coal near........192
Deweytown section.............97
Diamond Carbon Black Co.....656
Dillon, Mary V., No. 1.....300, 393
Dixie Mine....................610
Doak, Charles, No. 1......292, 329
Doddridge County:
    Area by districts.............6
    Description of................6
    Elevation of..................6
    Farm products................7
    Population of.................6
    Sections in................69-89
    Towns of.....................8
    Valuation of property.........7
    Well records in.........287-405
    Well records, Summarized. 290-303
Dola, Population of............31
Dola sections.............205, 232
Dolan, M., No. 1..............412
Dotson, D. L., No. 1......296, 352
Dotson, Finley, No. 1.....296, 363
Douglas, S. H., No. 1......298, 368
Drummond, F. J., No. 1512....418
Duckworth, W. A., No. 1..296, 366
Dunkard coal 151
Dunkard formations, Description of.................143-177
Dunkard sand, Big............274
Dunkard sand, Little..........273
Dunkard series:
    Age of......................177
    Description of..............132
    Doddridge Co., Sections of. 136-140
    General section of..........134
    Harrison Co., Sections of. 140-143
    Thickness of...............130
Dunkin, W. F..................27
Dye & Wise Nos. 1 & 2........290

E

Eagle District, Area of........11
Eagle District, Minable coal...626
Eagle District, Prospective oil.505
Eagle District sections ...104-107
Eagle District well records.. 484-505
Eagle Mills, Coal near........158
Eddy, Isaac, Nos. 1 & 2.......302
Edgell, Chas., No. 1...........292
Edgell, E. E., No. 1...........414
Edgell, T. B., Nos. 1 & 3......292

Page
Edgell, W. N., No. 2147...410, 447
Electric Railroads...............3
Elk creek..................36, 43
Elk District, Area of...........11
Elk District, M'nable coal.....631
Elk District, Prospective oil...559
Elk District sections 126-129
Elk District well records..554-559
Elk Lick coal 242-245
Elk Lick limestone 245
Elk silt loam 686
Ellifritt, . F., coal mine.......162
Elliott, S. A., No. 1.......420, 520
Elm Grove limestone.........176
Engstrom, Harold............656
Enterprise, Acct. of............29
Enterprise gauging station.....37
Eshenfelder, A. W.............16
Estlack, E. M., No. 2..........410
Estlack, F. S., No. 1..........290
Ewing limestone..............262

F

Fair Ground Imp. Co. No. 1....422
Fairmont & Balto. C. & C. Co 564, 601, 638
Fairmont & Clarksburg Traction Co.......................3
Fairs, Walter S., No. 1........416
Fancher, Wm., No. 1..........420
Farnum, Population of.........31
Fauna of Ames limestone..253-255
Fayette Coal Co......564, 587, 635
Fifth sand....................283
Fifty-foot sand...............278
Finley Heirs, Loretta, No. 1...414
First Cow Run sand..........273
Fish Creek coal 149
Fish Creek sandstone 149
Fisher, Chas., No. 1......300, 385
Fisher, Louisa (Fred), No. 3. ....300, 392
Fittro, Silas, No. 1.......412, 459
Fittro, Silas, No. 2.......412, 452
Flanagan, A. W. P., No. 2.....412
Flanagan, James, No. 2145.410, 450
Flanagan, S. T., No. 1.....410, 446
Flanagan, Wm., No. 1.........298
Flannagan Heirs...............80
Fleming, Lafayette, No. 1.296, 361
Fleming, Sanford, No. 1..414, 477
Flint, John, No. 2.............412
Flint Run.....................36
Flowers, F., stone quarry.....201
Foley, B., et al., No. 1........296
Folsom oil pool...............286
Fonda sections............92, 142
Forests 653-655
Ford Heirs, I. H., core test....290
Ford, E. O., No. 1.............296
Fortney, Clara, No. 1.........410
Fortney, Ellis, No. 1......418, 497
Fossil fauna..............253-255
Foster No. 1..................424
Fourth sand..................282
Fox, Robt., et al., No. 1........424
Freeman Bros. No. 1..........294
Freeman Heirs No. 1..........302
Freeman, Joseph, No. 1.......296
Freeman, J. F., No. 1.........424
Freeman, Wm., No. 1.........296

Page
Fretto, S., No. 4..............412
Friendsville coal.............256
Frum, George, No. 1......290, 315
Frum, S., No. 153..............310
Frum, Solomon, No. 1..........290
Fuel ratio....................565
Fuel tests of coal.604-606, 609-610
Fulton green shale............197
Fultz Heirs No. 1092..........412
Fultz, J. M., Nos. 4 & 6....412, 464
Furner, H. M., No. 1.....414, 471

G

Gabbert, Mary E., No. 1.......300
Gain, Columbus, No. 1........412
Gainer, L., No. 1..............300
Gaines, Samuel, No. 2.........412
Gamp, John, No. 1........300, 385
Gantz sand...................278
Gaston, Clark, coal mine.......212
Gaston, Ella M., No. 1........298
Gaston, Enoch, No. 1.....424, 551
Gaston, Morris, coal mine.....163
Gaston, S. M., No. 1......298, 375
Gaston, Wm., No. 1......414, 482
Gawthrop, D. H...............118
Gemps, John, No. 1.......300, 385
General sections:
  Conemaugh series...........220
  Dunkard series..............134
  Monongahela series.........179
Geologic structure............48
George Heirs mine............158
Geo-syncline 53
Gifford, F. M., No. 1......408, 439
Gifford, T. F., No. 2102....422, 524
Gilboy sandstone.............186
Gilmore coal..................145
Gilmore limestone............146
Gilmore sandstone............145
Glacial effects..............35, 47
Glass Industries:
  Doddridge county.............8
  Harrison county...........15-17
Glen Falls, Acct. of............30
Glen Falls section.............227
Glen View Brick Co...........648
Goff, Nathan No. (   )........422
Goff, Nathan, No. 39.......408, 439
Goff, Nathan, No. 45.......92, 408
Goodhope, Population of........31
Goodhope sections.........103, 223
Goodwin, John No. 2..........410
Goodwin, John T., No. 1..410, 453
Gordon sand.................280
Gordon sand data, Table, Stout field..................378
Gordon Stray sand............279
Gore Station section..........181
Gore, Howard, No. 1......418, 504
Gore Heirs coal mine......233, 640
Grafton sandstone............248
Grangeville, Coal near.........191
Grant Dist., Doddridge, Area of.6
Grant Dist., Doddridge, Minable coal.....................621
Grant Dist., Doddridge, Prospective oil.................350
Grant Dist., Doddridge, sections 74-79

Page

Grant Dist., Doddridge, Well records 327-349
Grant Dist., Harrison, Area of.11
Grant Dist., Harrison, Minable coal 630
Grant Dist., Harrison, Prospective oil..................553
Grant Dist., Harrison, Sections 122-126
Grant Dist., Harrison, Wells. 538-554
Graselli Chemical Co...........18
Grassland sections........120, 235
Gravels 651
Graves, Frank, No. 1..........412
Gray, David W., Nos. 1 & 2.. ....298, 373
Gray, W. M., No. 1...107, 420, 516
Gray, W. M., Coal on.....516, 640
Greathouse, A. M., No. 1..300, 392
Greenbrier Dist., Area of........6
Greenbrier Dist., Minable coal.624
Greenbrier Dist., Prospective oil 405
Greenbrieer Dist., Sections .87-89
Greenbrier Dist., Well records 396-405
Greenbrier limestone, Acct. of 276
Greenbrier limestone, Thickness of.....................130
Greenwood, Acct. of............10
Greenwood, Coal near.........162
Greenwood section.............80
Gribble, C. S., No. 1..124, 424, 548
Gribble, G. M.................124
Gribble, J. M., coal mine......188
Gribble, John. No. 1......300, 393
Gribble, John, Nos. 2 & 3.... ....300, 391, 392
Gribble & Dufore No. 1....296, 356
Griffin, B. F., No. 1......416, 491
Griffin, Nancy, No. 6.....422, 449
Griffith, W. C., No. 1..........296
Grimsley, G. P..169, 170, 176, 177, 197, 643, 644, 647, 648, 652, 653
Grove section..................84
Grove, Coal near..............163
Gunton, W. B., Coal Co...... ....564, 596, 637
Gypsy, Acct. of................28
Gypsy sections...........181, 214

H

Haas, Frank..................615
Hackers creek..............36, 44
Haggerty, E. L. (Nancy), No. 1 ....410, 448
Hall, H. A., No. 1.............416
Hall, J. M., No. 1.....102, 416, 476
Hall, Mary, No. 2.........408, 427
Hall, Omar E., Nos. 1 & 3.... .... 408, 431, 433
Hall, W. L., No. 3........416, 476
Hall, W. R. G., No. 5......408, 431
Hamrick, S. E., No. 1........ ....110, 422, 504, 524
Haney, F. M., No. 1.......412, 462
Haney, John, No. 1.......412, 468
Hansford, S. A., No. 1.........298
Harbert, G. E., No. 1.....412, 458
Harbert, Jesse A., No. 1...412, 463
Harbert, J. A., No. 2142...418, 495
Harbert, Luther, No. 1....... ....420, 508, 509
Harbert, Noah, No. 1..........410
Harbert, Thos. E., No. 1.......418
Harbert, W. B., No. 607.......290
Hardesty, G. L., No. 7.....420, 514
Hardesty, R. R., No. 1....... ....287, 420, 511
Hardesty, Wm., No. 1.........416
Hardman, H. H., No. 1........292
Hardman, O. W. O., No. 25... .... 292, 325
Hardman, O. W. O., No. 54... .... 292, 326
Hardman oil pool.............285
Hardway, Austin, No. 1.......414
Hardway, John H., No. 1..... .... 424, 544
Harker, Robt., No. 1.......296, 353
Harlem coal.......256-261, 617-618
Harris, Dan H., Nos. 2 & 3.. .... 298, 365
Harris, Gary, coal mine...209, 633
Harris, John, No. 1.......298, 365
Harris oil pool................286
Harrison County:
  Area by districts............11
  Coal production of.......561-564
  Description of................10
  Elevation of................11
  Population of...............11
  Products of.................12
  Towns of................13, 31
  Valuation of property........12
  Well records...........406-559
  Well records, Summarized.. 406-426
Harrison Co. Coal Co....... ....563, 593, 636
Harry B. C. & C. Co...564, 609, 639
Hart Bros. Machine Co.........18
Hart, Ira 18
Hart, J. B...................18
Hartley Heirs, A. W., No. 1.. .... 420, 514
Hartley Heirs, A. W., No. 3.. .... 420, 515
Hastings Run, Coal on........259
Haught, D. M., No. 1......298, 370
Haught, Eli, No. 1............292
Hawker, Thos., No. 1..........416
Hawkins, W. B. No. 3.........292
Haymond, Henry............. ....4, 20, 24, 25, 26, 39
Haymond, Luther, No. 1..410, 452
Haymond, Luther, No. 15..410, 453
Haywood Coal Min. Co...... ....563, 582, 634
Hazel-Atlas Glass Co...........16
Herald, John, No. 1.......408, 436
Heffner, Harvey, No. 2038.414, 478
Heldreth, B. F., No. 1.....418, 495
Heldreth, Benj., No. 1.....408, 442
Heldreth, Lemuel, No. 1.......418
Heldreth, Mary E., No. 1..408, 429
Heldreth, O. E., No. 2.....408, 428
Heldreth section...............69
Helmick, B. D., No. 1476..294, 338
Henry, Eugene, coal tests.....298

Page

Hero C. & C. Co.......536, 590, 636
Hess, Isaac, No. 1............416
Hession, John, No. 1......294, 349
Hickman, Lewis, No. 1....302, 402
Hickman, Wm., No. 1.........410
High Grade Coal Co...564, 572, 633
Highways 4
Hill, S. F., No. 1..............290
Hinkle, Abe, No. 1............302
Historical and Industrial development 1-32
History of transportation.......1
Hite, B. H....................565
Hochstrasser, P. E.............15
Holston silt loam.............691
Holt, J. F. (F. M.), No. 1......420
Horner Hdw. Co. No. 1....418, 501
Horner, Wm. H., No. 1........424
Hood Bros. No. 1.............418
Hoskinson, Emma, No. 2079 (No. 1)................294, 331
Hostetter coal.................148
Howard, C. D..................509
Howe, H. C....................663
Hudson, J., core test.......71, 290
Hughes River, South Fork of. 36, 46
Hundred coal..................153
Hundred sandstone............153
Huntington silt loam..........689
Hurst, Andrew (J.), No. 1.300, 384
Hustead, H. N., No. 1.........418
Hustead, Ida M., No. 1........418
Huston, H. H., No. 1......410, 448
Hutchinson Coal Co.:
  Byron mine.........563, 613, 639
  Delta mine..........563, 597, 637
  Erie mine...........563, 593, 636
Hutson, Jamison, No. 1...... ....138, 290, 317
Hutson, Perry, No. 1..........296

I

Ice, Isaac, No. 2..............292
Ideal Window Glass Co..........8
Industrial Home for Girls....21-24
Industrial Home Nos. 1 & 2....412
Industries of Clarksburg 15
Industries of Salem 20
Industries of West Union.......8
Infancy of rivers...............33
Injun oil sand................277

J

Jack Run section.............109
Jackson, Bart, No. 1..........424
Jackson, T. M..............3, 122
Jackson, T. M., quarry....... ....195, 187, 652
Jarvis Heirs, L. D., No. 1..420, 521
Jarvis, Wm., No. 1............414

Page

Jarvsville, Acct. of............31
Jarvisville, Limestone near....198
Jarvisville oil pool............286
Jett, Lindsay, No. 1...........418
Jewett, C. G...................19
Jewett, E. B...................18
Jimtown 32
Jimtown, Coal near...........205
Johnson, Miss C. N., No. 1.. .... 422, 533
Johnston, J. L............182, 202
Johntown, Population of.......31
Johnstown section.............128
Jollytown coal................152
Jollytown sandstone...........151
Jones, C. R...................508
Jones, S. O., No. 1............296
Joseph, Sydney, Nos. 1 & 2.. ....292, 320
Joy, Coal near................162

K

Katys Lick section.............94
Keener sand..................277
Kelley, D. A., No. 1.......300, 396
Kelley, Malissa, No. 1.....408, 429
Kelley, G. W., No. 1.......410, 445
Kelley, Coal near.............191
Kelly, Limestone near.........194
Kelly section...................83
Kennedy, W. G., No. 1.....424, 546
Kester, Chas 18
Kester, L. O., No. 1.......294, 336
Kester, W. G., No. 1.......422, 529
Kile, Virginia B., No. 1........418
Kincheloe creek............36, 41
Kiirk, Ellen, No. 1........294, 348
Kittanning Coal, Upper....619-620
Knapp, F. M..................657
Knight, Henry, No. 1......292, 329
Koblegard, R. R...............17
Krak, J. B....................565
Krenn, Joseph, No. (3?)...300, 385
Kroger-Gale Coal Co..564, 572, 633
Kyle, Luther E., No. 1....290, 308

L

Lafayette Window Glass Co....16
Lambert, W. C., No. 1.........408
Lambert Run Coal Co....... ....563, 591, 636
Lancaster, Geo., No. 1.....422, 536
Lang, Hampton, No. 1.....422, 535
Lang and Cornell, Coal on.....258
Lange & Crist B. & L. Co.......19
Langfitt, Silas, No. 1..........292
Langfitt, Silas, Nos. 4 & 7.292, 324
Langfitt, S. W................659
Lanham, Chas., No. 1 (Kinch).412
Lanham, Chas., No. 1 (South Penn) 412, 464
Lanham, L., No. 1............414

Page
Late, G. B.................27, 237
Latimer, W. J.................661
Lawson, A. D., No. 6......302, 405
Leach, F. A., No. 1............298
Lee Brick plant...............649
Lesley, J. P.................216
Levels on B. & O. R. R.:
  Grafton and Parkersburg Branch 696
  Monongahela River Branch..696
  W. Va. and Pittsburgh Branch 697
  W. Va. Shortline Branch....697
Lewis (Lynch Mines) section..230
Lewis, John, coal mine........209
Lewis, L. Nathan, No. 1.......424
Lewis, Samuel, coal mine.....208
Lewis, V. A...........7, 10, 14, 20
Life periods, Land and streams.33
Limestones for roads.........650
Little Clarksburg coal.........231
Little Dunkard sand..........273
Little Pittsburgh coal.........227
Little Tenmile creek section...232
Little Washington coal........170
Little Waynesburg coal.......186
Location, Doddridge-Harrison Area 1
Lodge, Morgan R., No. 1..422, 531
Lodge, Morgan R., No. 2..422, 532
Long, C. M., No. 1............422
Long, Frank, No. 1...........422
Long, L. L., No. 1.........422, 537
Long Run, Coal near..........162
Long Run oil pool.............286
Long Run section 77
Lost Creek, Coal at...........261
Lost Creek Sta., Acct. of.......30
Lost Creek, Meteorological data 662-666
Lost Creek sections...124, 211, 223
Lost Creek 36, 43
Loudin, L. R., coal mine...207, 633
Lough, J., No. 1...........410, 452
Lower Carboniferous rocks.....69
  Thickness of...............130
Lower Marietta sandstone.....156
Lower Pittsburgh limestone...228
Lower Pittsburgh sandstone...224
Lower Sewickley sandstone....201
Lower Uniontown coal........195
Lower Washington limestone..156
Lowndes & Hart No. 11.......292
Lowther, Haymond, coal mine.163
Lucas Bros. No. 1.....418, 507, 508
Lucas Bros. No. 4.....418, 508, 509
Lumberport, Acct. of...........26
Lumberport sections 106, 233
Lumberport Steam Coal Co.. ....564, 589, 635
Lynch, Hiram, Nos. 3, 14 & 44.412
Lynch, Population of...........32
Lynch Mines (Lewis) section..230

Page
Lyons No. 1..............422, 526
Lyons Heirs, James, No. 1....418
Lyons, Emma, No. 1..........420
Lyons, Sylvester, No. 1........418

M

Madeira-Hill-Clark Coal Co.:
  Goff mine...........564, 601, 638
  New Chieftain mine.564, 598, 637
  Randolph mine......564, 598, 637
  Waldo mine.........564, 600, 638
Mahoning sandstone...........269
Maken, Population of...........32
Mannington sandstone........170
Mapletown coal...............200
Margaret section..............141
Marietta river 35, 47
Marietta sandstone, Lower ...156
Marietta sandstone, Middle ...155
Marietta sandstone, Upper 153
Marion Gas Coal Co...564, 578, 633
Market, Coal near.............163
Marquard, H. E................19
Marsh, E. J., No. 1............416
Marsh, I. L., No. 1.....90, 410, 445
Marshall Coal Co.....564, 611, 639
Marshville, Limestone near....198
Martin, Geo., No. 1...........420
Martin, G. C., No. 1...........256
Martin, Hugh, No. 1..........420
Martin, Jennie (G. M.), No. 1. ....418, 496
Martin, L. A., No. 1...........416
Martin, O. C., No. 1...........418
Martin, T. B., No. 3...........420
Marts, Mollie, No. 1..........416
Mason, A. P., No. 1...........416
Mason, Effie M., No. 1........418
Mason, John R., No. 1.........416
Mason, W. P., No. 1..........416
Mason, W. P., core test.......416
Mathers, Ben, No. 1.......418, 502
Mathews, Caroline, No. 1.... ....106, 418, 502
Mathey, A., No. 3.........414, 475
Mathey, A., No. 6.........416, 475
Maturity of rivers..............33
Mauch Chunk series, Thickness 130
May, C. W......................5
Maxton sand.................275
Maxwell, Edw. (Haymond), No. 1...................414, 477
Maxwell Heirs, Frank, No. 1..296
Maxwell Heirs No. 1...88, 302, 400
Maxwell, Isaac, Coal on...... ....260, 261, 640
Maxwell, James, No. 1.....300, 383
Maxwell, J. B., Nos. 1 & 2.... .... 300, 390
Maxwell, Lee, No. 1...........414
Maxwell, Leeman, No. 1...414, 471

Page
Maxwell, Leeman 214
Maxwell, Leeman, Nos. 4 & 6 ....296, 355
Maxwell, Lewis, No 2 (129) 294, 346
Maxwell, Lewis, No. 6 (166) 296, 357
Maxwell, Lewis, No. 1 (167) 296, 360
Maxwell, Lewis, No. 1 (171) 296, 357
Maxwell, Lewis, No. 1 (172) 296
Maxwell, Lewis, No. 2 (173) 296, 358
Maxwell, Lewis, No. 1 (257) 300, 388
Maxwell, Porter, Nos. 31 & 34 ....300, 389
Maxwell, Porter, No. 1982.424, 549
Maxwell, Porter, No. 2039.424, 550
Maxwell, W. Brent, No. 6.298, 374
Maxwell, W. B., Nos. 2 & 8 ....298, 376
Maxwell, W. B., No. 1.300, 386, 395
Maxwell, W. B., No. 4....298, 377
Maxwell, W. B, No. 2005 ....414, 477
Meadowbrook, Acct. of....29
Meek, Ella, No. 1....412
Meeks, Henry, No 1....302
Meeks, J. H., No. 1....302, 400
Meigs clay loam....675
Mercer coal, Lower (?)....516, 610
Michael, Harriet A., No. 2342 ....418, 494
Middle Island creek....36, 44
Middle Marietta sandstone....155
Middle Washington limestone..156
Miletus section....88
Millan, Geo. W., No. 1....418, 506
Mineral, Coal near....212
Mineral, Population of....31
Mineral section....183
Modern Window Glass Co....20
Moffett, G. W., coal mine (West Milford coal)....216, 640
Moffett, H. G. (No. 6)....302
Moffett, Rush, No. (1)....416
Monongah Fuel Co....579, 633-634
Monongahela River Branch....2
Monongahela Series, Description of....178-219
Monongahela Series, General section 179
Monongahela Series, Thickness 130
Monroe Colliery Co....563
Monticello Brick Co....241, 647
Monticello Brick Co. No. 1....422
Moon, Elizabeth, No. 1....412, 457
Moon, Elizabeth, No. 3....412
Mooney, C. N....661
Moore (Hawker) I., No. 1..416, 488
Morgan, Jas., No. 1....294

Page
Moore, Chas. T., coal mine.296, 637
Morgansville 9
Morgansville, Coal near....188
Morgantown sandstone....241
Morris, James M., No. 2....410
Morris, James, No. 3....412, 456
Morris, Loretta, No. 1....416, 489
Morris, T. S., No. 1....412, 464
Morris, Z. W., No. 1....416
Moshannon silt loam....690
Mottet, Louis....20
Moundsville sand....174, 273
Mountain State Carbon Co.656, 659
Mount Clare, Acct. of....28
Mowrey, Wm., No. 1....302, 404
Mowrey, Wm., No. 2....302, 405
Myers, Stephen, No 1....416, 475

Mc

McAlpin, Coal near....233
McBride Lamp Chimney Co....21
McBride, Thos. F....21
McClain, Geo. (S. L.), No. 2 ....300, 387
McClain, P. B., No. 1....296, 352
McClellan District, Area of....6
McClellan District, Minable coal 621
McClellan District, Prospective oil....326
McClellan District, Sections in 69-74
McClellan District, Well records in....304-326
McConkey, Jacob, No. 1 ....104, 414, 481
McCormick, Harriet, core test..292
McDonald, J. H., coal mine....577
McElroy creek....36, 45
McGeorge quarry....652
McIntyre, James, coal mine 211, 633
McIntyre, John Q., No. 1..420, 525
McIntyre, Lloyd, No. 1....292, 326
McIntyre, Margaret (E. R) No. 2....408, 440
McIntyre, Stonewall, No. 1....420
McIntyre, Z. L., No. 1....408, 438
McKinley, Thos. J., Nos. 1 & 2.416
McMillan, C. I., No. 1.294, 331, 334
McMillan, M. A., Nos. 1 & 2 ....294, 331, 334
McMillan, S. B., No. 1.294, 331, 332
McReynolds, J. D., No. 1 ....75, 292, 328
McReynolds, J. D., No. 4..292, 328
McReynolds, J. D., No. 17....292
McReynolds, John, No. 1....292
McWhorter, Goff, No. 1....424
McWhorter, W. H., No. 3..424, 548

Page

N

National Carbon Co..............18
National Coal Co......563, 587, 635
Netzer, Jacob, No. 1.......296, 360
Newberry, J S...............256
New Milton, Acct. of..........10
New Milton District, Area of....6
New Milton Dist., Minable coal 623
New Milton Dist., Prospective oil 395
New Milton Dist., Section ..85-86
New Milton Dist, Well records 386-396
New Milton, Coal near.........163
New Milton, Limestone near...193
Nicholson, D. H., No. 1..86, 300,394
Nicholson, D. H., coal mine.. .... 165, 633
Nicholson, Nancy, No. 1979.. .... 414, 479
Nineveh coal 147
Nineveh limestone 147
Nineveh sandstone 147
Northwestern turnpike..........4
Nose of anticlines..............48
Numan section..................78
Nutter, Eli, No. 1.........298, 374
Nutter, Granvile S., No. 1932. .... 298, 373
Nutter, Henry, No. 1..........416
Nutter, S, No. 1..........414, 471
Nuzum, Geo. P., No. 1.........410
Nuzum, John, No. 1.......422, 532
Nuzum, Nimshi, No. 1.....420, 517
Nuzum, Nimshi, No. 4.....420, 516
Nuzum, Sanford, No. 1........414

O

O'Connor, Mary, No. 1.....294, 348
Offut, Z., No. 1................294
O'Gara Coal M. Co....564, 597, 637
Ogden, Ellsworth, No. 1.......416
Ogden, Silas, No. 1........420, 521
Ogden, V. B., No. 1........418, 502
Ogden, V. B., No. 2........418, 503
Oil and gas, History of.......285
Oil and gas sands, Interval to Pittsburgh coal.............272
Oil and gas sands, Table 271
Oliphant, F. H................284
Olive, Coal near...............167
Oral, Population of.............32
Oral section...................251
Orr, E. D., No. 1..........408, 438
Orr, R. M., coal mine.....161, 633
Orr, R. M., No. 1..........294, 341
Orrowhood, H., well.......294, 343
Orton 250

P

Parr, A. D., No. 1 (Smith-Williams) 412, 469
Parrish, F. A., No. 3..........408

Page

Parrish, F. J., Nos. 1 & 2......408
Parrish, S. N., No. 2......408, 435
Patterson No. 3...........412, 460
Paugh, Levi, No. 1352.....422, 539
Payne, Genius, Nos. 3 & 2.... ....97, 414, 467
Payne, G., No. 6..........414, 468
Payne, G., No. 10.............414
Peacock Coal Co......563, 588, 635
Pearcy, C. C., No. 1........300, 390
Pearcy Heirs, L. W., No. 1.. .... 300, 391
Peerless Carbon Black Co..656, 660
Peerless Window Glass Co......15
Peneplain, Evidences of........33
Peora, Population of...........32
Peora, Coal near..............206
Peora section.................213
Permian rocks.................132
Permo-Carboniferous rocks....132
Petroleum and Natural gas, Chapter on..............270-559
Phillips, M. A., No. 1..........292
Phillips S. & T. P. Co...........17
Physiography, Chapter on....33-47
Pigeon Run section............213
Pigott, Chas., core test........296
Pigott, E. L., No. 1...141, 408, 428
Pigott, Seth, No. 1........410, 442
Pigott, W. Harrison, No. 1.....296
Pine Bluff section 180
Pine Creek limestone..........268
Piracy of streams..............34
Pitcairn Coal Co.......564, 609, 639
Pittsburgh coal....216-218, 573-577
Pittsburgh coal, Amount of.. 616-617
Pittsburgh coal, Commercial mines 577
Pittsburgh coal, Map of.......574
Pittsburgh coal, Little 227
Pittsburgh limestone, Lower...228
Pittsburgh limestone, Upper...225
Pittsburgh red shale..........264
Pittsburgh river 35, 47
Pittsburgh sandstone, Lower ..224
Pittsburgh sandstone, Upper ..216
Pittsburgh-Washington coal interval 51
Platt, Messrs.................245
Pocono sandstones, Thickness of 130
Population:
  Doddridge county...........6, 7
  Harrison county...........11, 12
Portage Series, Thickness of...130
Porter, Hattie, No. 1...115, 422, 529
Post, Chas., No. 1.............424
Post, Earl, No. 1..............414
Post, E. W., No. 1........424, 557
Post, Jacob, coal mine.....576, 639
Post, W. W., No. 1............414
Post, Wirt, No. 1..............414
Potteries 643-644
Pottsville Series, Table.........68
Pottsville Series, Thickness....130
Powell & Williams No. 1..294, 338
Powell, B. C., No. 1...........298
Powell, H. T., No. 1467....294, 337
Powell, James, No. 1..........294
Powell, T. W., No. 2012........337
Pratt, W. W., No. 1...........294

Page
Precipitation at Central Station 663, 664
Precipitation at Lost Creek... .... 662, 665
Price, Mary, No. 1.........424, 551
Pritchard No. 1...............422
Proctor sandstones............143
Prospective Oil and Gas Areas:
  Doddridge County:
    Central district............369
    Cove district..............385
    Grant district.............350
    Greenbrier district........405
    McClellan district.........326
    New Milton district.......395
    Southwest district.........380
    West Union district.......362
  Harrison County:
    Clark district.............530
    Clay district..............522
    Coal district..............527
    Eagle district.............505
    Elk district...............559
    Grant district.............553
    Sardis district.........450-451
    Simpson district...........537
    Ten Mile district..........473
    Union district.............483

Q

Queen, J. P., coal mine........210
Quiet Dell, Population of.......31
Quiet Dell sections.......117, 252

R

Radabaugh, Rosa, core test....420
Radford Pottery Co........19, 644
Railroads, Electric 3
Railroads, Steam 2
Randolph, A. F., No. 1.....300, 388
Randolph, Franklin, No. 1.300, 388
Randolph, John F., No. 1..412, 459
Rastle, John, No. 2........300, 385
Raven Carbon Co..............657
Rector, J. N., No. 1.......424, 545
Redstone coal 203-212, 569-573
Redstone coal, Map of.........570
Redstone coal, Table of wells recording 204
Redstone limestone 212-216
Reed, R. L., No. 1.....109, 420, 519
Reed & Cox No. 1.............420
Reed, W. B., No. 1............424
Reger, I. S., No. 1.........424, 558
Reynolds, B. F., No. 2.........422
Reynolds, Frank, No. 1........418
Reynolds, Thos., No. 1....422, 523
Reynoldsville mine............597
Rhodes, Alonzo, No. 1.....412, 469
Rhodes, Arthur, No. 2.....414, 483
Rhodes, Chas. W., No. 1.......414
Riblett, Daniel, coal mine......575
Richard, Joseph, No. 1.....302, 401
Richards, Geo. T., No. 3...302, 404
Richards, Geo. T., No. 3........88
Riffee, I. N., No. 1........290, 318
Riffee, I. N., No. 2........290, 317
Righter, Abraham, No. 1..420, 521
Rinehart, Geo., No 1..........420
Ritter, Mary E., No. 1........290
Ritter, O. S., No. 1........408, 436
Page
River channels 40
River terraces 47
Road material.............650-651
Robey, F. L., No. 1........418, 500
Robinson, Alva, No. 1.....408, 429
Robinson, C. D., No. 2157..418, 499
Robinson, Fletcher, No. 1..418, 497
Robinson, Frederick, No. 1.....408
Robinson, Isabel, No. 1........420
Robinson, James A., No. 1.....416
Robinson, O., No. 2159....422, 449
Robinson, Wesley, No. 5...408, 434
Robinson No. 1........95, 412, 468
Robinson Fork oil pool........286
Robinson syncline.............61
Rock column, Table of.......67-68
Rockford, Population...........31
Rockport limestones...........146
Rock Run Carbon Black Co... .... 657, 659
Rogers, B. F., No. 1788....418, 496
Rogers, B. L., No. 2.......408, 437
Rogers, E. E. S., No. 2140..410, 445
Rogers, H. D...................216
Rogers, H. H.....................3
Rogers, John G., No. 1....410, 444
Rogers, Nancy, No. 2.........416
Rogers, R. M., No. 2293...418, 498
Rogers, T. D., No. 1.......410, 452
Rogers, W. A., No. 2......408, 442
Romines Mills, Population of...31
Romines Mills section.........126
Rosebud Fuel Co......563, 589, 635
Rosier Heirs, Jos., No. 1...412, 456
Rough stony land.............692
Roy, Chas. J., Coal near.......259
Roy, Chas. J., No. 1.......422, 535
Ruraldale anticline.............60
Ruley, F. J., No. 1............296
Ruppert, Jacob, No. 1......300, 383
Rush, Gordon, No. 1.......294, 346
Rush Run sandstone..........150
Rusk, W. A., No. 1............416
Russell, E. O...................28
Russell, Geo., No. 1...........290
Russell, Hamilton, No. 1.......298
Ryan, Thos., No. 1.............296
Rymer, John W., No. 1....300, 393

S

Sadler, Jesse, No. 1...........302
Sadler, Minerva, No. 1.....300, 397
Sadler, Susan, No. 1.......294, 340
Saint Clara oil pool...........286
Saint Clara section 85
Salem, Acct. of.................20
Salem, Glass industries.........20
Salem Cooperative Window Glass Co....................20
Salem oil pool................287
Salem section 95
Salt sand.....................275
Saltsburg sandstone...........264
Sandusky clay pit.............644
Sandusky, Gideon..............27
Sandusky, J. B., core test..422, 533
Sandy, Wm., Nos. 1 & 2........294
Sapp, E. M., No. 1.............420
Sardis, Acct. of................31
Sardis District, Area of........11
Sardis District, Minable coal...625

Page
Sardis District, Prospective oil and gas....................450
Sardis District, Sections 90-94
Sardis District, Well records. 426-451
Schmidt, John H., No. 1...300, 383
School house lot No. 1.........298
Schuchert and Clark...........122
Scott, Nancy, No. 1............296
Second Cow Run sand.........274

Sections, Geologic:
  Adamsville 107
  Adamston 117
  Alliance 141
  Ann Run......................222
  Ashley 136
  Beards Run...................223
  Benson 102
  Big Battle....................74
  Big Isaac...............89, 140
  Boothsville 109
  Bridgeport 119, 245, 251
  Brown 90
  Brushy Fork..................208
  Byron 122
  Canton 75
  Cascara 137
  Centerpoint 72
  Central Station..............139
  Clarksburg 112, 182
  Coldwater 86, 139
  Conemaugh series............220
  Deweytown 97
  Dola 205, 232
  Dunkard series, General.....134
  Fonda 92, 142
  Glen Falls...................227
  Goodhope 103, 223
  Gore Station.................181
  Grassland 120, 235
  Greenwood 80
  Grove 84
  Gypsy 181, 214
  Heldreth 69
  Jack Run.....................109
  Johnstown 128
  Katys Lick....................94
  Kelly 83
  Lewis (Lynch Mines).......230
  Little Tenmile creek........232
  Long Run......................77
  Lost Creek.........124, 211, 223
  Lumberport 106, 233
  Margaret 141
  Miletus 88
  Mineral 183
  Numan 78
  Oral Station.................251
  Peora 213
  Pigeon Run...................213
  Pine Bluff...................180
  Quiet Dell..............117, 252
  Romines Mills...............126
  Saint Clara...................85
  Salem 95
  Sedalia 70
  Summers 82
  Tollgate 172
  West Clarksburg 238
  West Milford 100, 246
  West Union 79

Page
  Wilsonburg 110, 115
  Wolf Summit....................99
  Wyatt 105
Sedalia section 70
Sedalia gas pool..............286
Sellers, R. E.................657
Seven Day Baptist No. 1...... .... 424, 540, 541
Sewickley coal................200
Sewickley limestone...........202
Sewickley sandstone, Lower....201
Sewickley sandstone, Upper...199
Shahon, H. J., No. 1..........290
Shaughnessy, Patrick, No. 1.. .... 294, 349
Shaw, Dan'l E., No. 1......416, 491
Sheets, O. A., No. 1...........294
Sherwood, Coal near...........189
Sherwood, G. W...........663, 664
Shewmaker, John..............656
Shinn, B. W., No. 1............418
Shinns Run......................36
Shinnston, Acct. of.............24
Shinnston Brick Co............649
Shinnton oil pool..........287, 511
Shinnston syncline.............63
Short, C. A...................649
Short, Chas., No. 1............418
Short Line Coal Co....564, 586, 635
Shrader, Chas., No. 1......294, 333
Shriver, Simon S., No. 2...416, 485
Simpson creek 36, 41
Simpson Dist., Area of.........11
Simpson Dist., Minable coal...629
Simpson Dist., Prospective oil.537
Simpson Dist.,, sections ...118-122
Simpson Dist., Well records.. 531-538
Sixth sand....................283
Slusser, Chas., No. 1..........302
Smith, Allen 665, 666
Smith, A. A., No. 1........424, 551
Smith, Blackburn, No. 1.......410
Smith Bros. limestone quarry.239
Smith, Dick, No. 1.........422, 527
Smith, E. E., No. 1........290, 317
Smith, Ed., No. 1..........296, 361
Smith, Frank, No. 1...........294
Smith, Frank, Nos. 1 & 2......296
Smith & Carr No. 1.......296, 526
Smith, Harvey, Nos. 1 & 2.296, 360
Smith, James, No. 1...........422
Smith, J. B., quarry.......230, 653
Smith, J. L., No. 1............294
Smith, J. Wesley, No. 1...296, 361
Smith, Martha J., No. 1.......294
Smith, Mordecai, No. 1........420
Smith, M. W., No. 1...........414
Smith & Burnside No. 1.......424
Smith & Robinson No. 1..... .... 70, 290, 305
Smith, Nancy, No. 1...290, 298, 310
Smith, Porter, quarry.........653
Smith, Temple, No. 2107...410, 444
Smith, Wm., No. 1.............296
Smith-Williams (Parr) No. 1. .... 412, 469
Smithton, Acct. of...............9
Smithton, Limestone near.....193
Snider, Mary V., No. 1462..294, 335
Snodgrass, Emeline, No. 1..292, 319
Snowfall at Central Station....664

Page

Snowfall at Lost Creek....662, 666
Soil Survey, Chapter on....661-695
Soils 671-695
Soils, Area of................675
Soils, Summary of.........692-695
Somerville, J. T., No. 3....302, 405
South & Cole. No. 1.............420
Southern Coal & T. Co.........564
Southern Carbon Co.......657, 659
Southern, G. W., core test.....420
Southern, Samuel, No. 1.......420
Southwest Dist., Area of........6
Southwest Dist., Minable coal.623
Southwest Dist., Prospective oil 380
Southwest Dist., sections ...82-83
Southwest Dist., well records. 370-380
Speechley sand..................284
Sperry, M. B., No. 1.............302
Spraker, E. L...................17
Squaw sand.....................277
Star Rig, Reel & Supply Co.....19
Stark, C., No. 1............292, 317
Stark, S. (C.), No 6.......290, 316
Stark, Seymour, No. 1.....418, 507
Starkey, C. L., No. 1..141, 414, 486
Starkey, Edith, No. 1......414, 475
Starkey Enoch (C. L.), No. 2. .... 416, 487
Starkey, Robt., No. 2..........294
Steam railroads.................2
Steaming tests of coal.........605
Steel Heirs No. 1..............296
Stevenson, J. J................145, 147, 149, 151, 152, 156, 170, 202, 212, 218, 229, 241, 248, 256, 265
Stevens Run, Coal on..........260
Stewart, Chas., No. 7......292, 328
Stewart, Henry, No. 1.....142, 408
Stewart Heirs, Jap, No. 1..296, 256
Stinespring, W. L., No. 1...298, 371
Stout oil pool.........286, 377, 378
Stout, Edith, No. 1............300
Stout, John, No. 2........408, 431
Stout, J. R., No. 1....119, 422, 535
Stout, L. E., No. 1........414, 467
Stout, Lloyd, No. 1............424
Stout, Samuel, No. 1..........290
Stout, Strother, No. 1......422, 535
Stout, S. W., Nos. 1, 2, 4 & 7. .... 298, 379
Stout, S. W., Nos. 18 & 19.298, 380
Stout, Wm., Nos. 8 & 10...... ....298, 300, 379, 389
Stout, W. Frank, No. 1.........422
Stratified rocks 67-68
Stratified rocks, Thickness of..130
Stratigraphy, Chapters on...67-269
Stray sand.....................279
Streams, Table of..............36
Strike of rocks.................48
Strother, Thos. J., No. 1.......410
Strother, W. M., No. 1.........410
Structure, Chapter on.......48-66
Stuck, L. D., No. 1.........298, 367
Sturms Heirs, J. F., No. 1.418, 510
Stutler, Harriet, No. 1.........414
Stutler, W. A., coal mine..189, 633
Stutler, W. A., No. 1......294, 345
Sullivan Heirs No. 1.......72, 292
Summers, Coal near...........190

Page

Summers section................82
Sweeney, Mahala, No. 1....292, 321
Swiger, A. A., No. 1.......410, 449
Swiger Coal Co............588, 635
Swiger, Daniel, No. 1..........290
Swiger, D. L., No. 1...........290
Swiger, E., No. 2316.......420, 512
Swiger, F. S., No. 1...........290
Swiger, H. E., No. 1...........420
Swiger, J. A., No. 1...........418
Swiger, J. L., No. 1.......410, 443
Swiger, Louisa C., No. 1......410
Swiger, P. E., No. 1...........290
Swiger, Susan P., core test....292
Swisher,Burgett No. 1.........424
Swisher, I. M., No. 1......424, 542
Syncline 48
Synclines, Description of:
  Burchfield 60
  Grassland 65
  Robinson 61
  Shinnston 63

T

Talbott, N. M., well........422, 527
Talkington, Acena. No. 1..408, 430
Talkington Heirs, Geo., No. 1. .... 408, 438
Talkington, G. W., No. 11..408, 433
Talkington, G. W., Nos. 14 & 15 408
Talkington, Jesse, No. 1...408, 430
Talkington, Jesse, No. 3.......408
Tallman, C. C., No. 1......414, 482
Tate Brothers No. 1.......294, 342
Tate, M. W. (Catherine), No. 1 ....290, 312
Tate, M. W. (Catherine), core test 290
Tate, S. T., No. 1.........290, 312
Taylor, Lee No. 1.............290
Taylor sandstone..............146
Teets, D. D., Jr...............578
Tegard, Morris, No. 1..........418
Temperature, Central Station..663
Temperature, Lost Creek..662, 665
Tenmile creek...............36, 41
Tenmile Dist., Area of.........11
Tenmile Dist., Minable coal....625
Tenmile Dist., Prospective oil.473
Tenmile Dist. sections 94-99
Tenmile Dist. well records.. 451-474
Terraces of rivers.............47
Thickness of series...........130
Thirty-foot sand..............279
Thomas, Joseph, No. 1.........290
Thompson, E. W., No. 1...420, 515
Tichenall, Moses, No. 1....420, 525
Tollgate section..............172
Topography of land............46
Towles, J. H., No. 1.......418. 504
Transportation, History of......1
Traugh, Martha, No. 1.....412, 452
Travis Glass Co...............17
Travis, H. E..................17
Tully limestone...............121
Turnpikes:
  Clarksburg and Philippi.......5
  Northwestern 4
  Shinnston and Middlebourne...5

Page

Tuna Glass Co..................16
Tyler silt loam 688
Tyler silt loam, Analysis of...689

U

Underwood, Elias, core test....290
Underwood, Jacob, No. 11..294, 330
Underwood, Joseph, No. 1........................ 292, 320
Underwood, Martin V., No. 2....................... 294, 332
Union Dist., Area of...........11
Union Dist., Minable coal......627
Union Dist., Prospective oil....483
Union Dist. sections 97, 103
Union Dist. well records..474-484
Uniontown coal 187, 568-569
Uniontown coal, Lower........195
Uniontown limestone..........193
Uniontown sandstone 186
Upper Carboniferous rocks......68
Upper Carboniferous rocks, Thickness of................130
Upper Kittanning coal.....619-620
Upper Marietta sandstone.....153
Upper Pittsburgh limestone...225
Upper Pittsburgh sandstone...216
Upper Sewickley sandstone....199
Upper Washington limestone..152
Upshur clay 678
Upshur silt loam 679
Upshur silt loam, Analysis of.680

V

Varner, A. J., No. 8.......410, 454
Vincent Coal Co...563, 608, 638-639
Vincent, S. L., No. 5.......420, 513
Va.-Md. Coal Corp....563, 584, 634

W

Wagner, John, quarry.........231
Wallace, Acct. of...............29
Walton, W. R., coal mine......163
Wanstreet, H. H., No. 1...298, 384
Wanstreet, John, No. 1....298, 381
Warner, C. H...................28
Washing test of coal..........609
Washington coal..157-168, 566-568
Washington Coal Co.......599, 637
Washington "A" coal..........154
Washington coal, Little........170
Washington-Pittsburgh coal interval 51
Washington fire clay shale.....168
Washington limestone, Lower .156
Washington limestone, Middle............................ 156
Washington limestone, Upper .152
Washington sandstone 169
Water-ways 1
Watson, Isaac, No. 1..........422
Waugh, L. D., No. 1...........302
Waynesburg coal 184
Waynesburg coal, Little.......186
Waynesburg "A" coal..........171
Waynesburg "B" coal..........171
Waynesburg limestone 186
Waynesburg sandstone 174
Webb, Eliza J., Nos. 1 & 2.290, 316

Page

Well records, Summarized:
  Doddridge county........290-303
  Harrison county.........408-425
West Clarksburg section.......238
West Fork Glass Co............17
West Fork river 1, 36
West Fork river, Channels 40
West Fork river, Tributaries ..40
West Fork river, Discharge 38
West Fork river, Slackwater on 39
West Milford, Acct of..........30
West Milford coal 246
West Milford coal, Analysis of 640
West Milford section 100, 246
Westmoreland silty clay loam.683
Westmoreland silty clay loam, Analysis 686
West Va. Industrial Home.....21
West Va. & Pittsburgh Branch..2
West Va. Pottery Co.......27, 643
West Va. Short Line............3
West Union:
  Account of...................8
  Coal near..................188
  Industries of.................8
  Population 8
  Section at..................79
West Union Dist., Area of.......6
West Union Dist., Minable coal........................... 622
West Union Dist., Prospective oil 362
West Union Dist., Well records 350-362
Whalen, John, core test.......294
Whalen, John, No. 2.......294, 344
White, Frank, No. 1.......424, 554
White, I. C..53, 71, 98, 132, 133, 143, 144, 147, 155, 169, 171, 174, 176, 186, 198, 199, 217, 218, 220, 225, 231, 237, 248, 250, 267, 268, 269, 285, 287
Whiteman, E. J., No. 2....420, 513
Whiteman, L. S., No. 1....410, 449
Whiteman, T. P., No. 1....410, 447
Wilcox, N. J., No. 1...........294
Williams, D. C., No. 120.......422
Williams, F. M............300, 397
Williams, G. W., No. 1........410
Williams, Harriet, No. 1.......412
Williams Heirs No. 1.........302
Williams, Johnson, No. 1......300
Williams, J. W., Nos. 1 & 2......................... 410, 452
Williams, J. W., Nos. 6 & 8....410
Williams, M. T., Nos. 1, 2 & 5...................300, 398, 399
Williams, Samuel, No. 2.......420
Williams, Thos., No. 1....412, 455
Williams, W. M., No. 1....300, 382
Williams, Wilson, No. 1...412, 464
Williamson Heirs No. 1........298
Willis, Jesse H., No. 1.........422
Willis, Jesse H., No. 3....422, 533
Willis, J. H., No. 1........420, 532
Wilson, F. L...................19
Wilson, M. H., No. 1......298, 375
Wilsonburg, Acct. of...........28
Wilsonburg, Electric line........3
Wilsonburg sections 110, 115